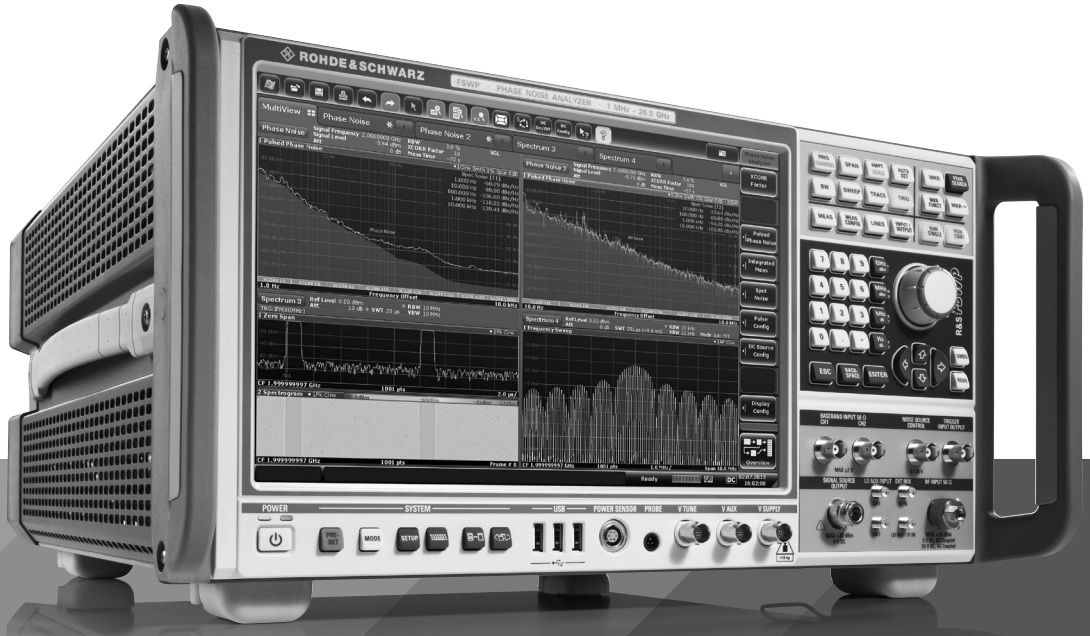
R&S®FSWP
PHASE NOISE ANALYZER AND VCO TESTER

3 year warranty

Specifications



Data Sheet
Version 11.00

ROHDE&SCHWARZ
Make ideas real

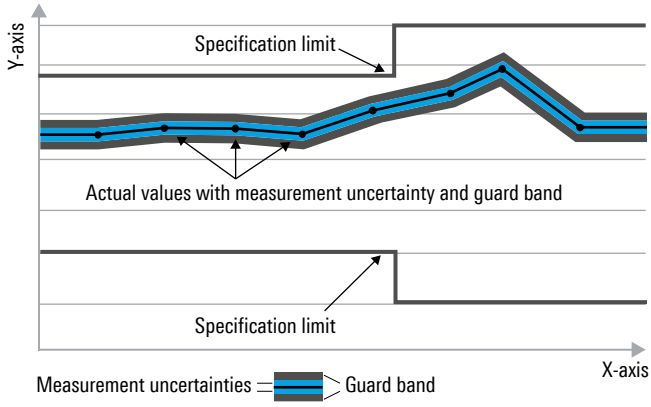
CONTENTS

Definitions

General
Product data applies under the following conditions:

- Three hours storage at ambient temperature followed by 30 minutes warm-up operation
- Specified environmental conditions met
- Recommended calibration interval adhered to
- All internal automatic adjustments performed, if applicable

Specifications with limits
Represent warranted product performance by means of a range of values for the specified parameter. These specifications are marked with limiting symbols such as <, ≤, >, ≥, ±, or descriptions such as maximum, limit of, minimum. Compliance is ensured by testing or is derived from the design. Test limits are narrowed by guard bands to take into account measurement uncertainties, drift and aging, if applicable.



Non-traceable specifications with limits (n. trc.)
Represent product performance that is specified and tested as described under “Specifications with limits” above. However, product performance in this case cannot be warranted due to the lack of measuring equipment traceable to national metrology standards. In this case, measurements are referenced to standards used in the Rohde & Schwarz laboratories.

Specifications without limits
Represent warranted product performance for the specified parameter. These specifications are not specially marked and represent values with no or negligible deviations from the given value (e.g. dimensions or resolution of a setting parameter). Compliance is ensured by design.

Typical data (typ.)
Characterizes product performance by means of representative information for the given parameter. When marked with <, > or as a range, it represents the performance met by approximately 80 % of the instruments at production time. Otherwise, it represents the mean value.

Nominal values (nom.)
Characterize product performance by means of a representative value for the given parameter (e.g. nominal impedance). In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

Measured values (meas.)
Characterize expected product performance by means of measurement results gained from individual samples.

Uncertainties
Represent limits of measurement uncertainty for a given measurand. Uncertainty is defined with a coverage factor of 2 and has been calculated in line with the rules of the Guide to the Expression of Uncertainty in Measurement (GUM), taking into account environmental conditions, aging, wear and tear.

Device settings and GUI parameters are designated with the format “parameter: value”.

Non-traceable specifications with limits, typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

In line with the 3GPP/3GPP2 standard, chip rates are specified in million chips per second (Mcps), whereas bit rates and symbol rates are specified in billion bits per second (Gbps), million bits per second (Mbps), thousand bits per second (kbps), million symbols per second (Msps) or thousand symbols per second (ksps), and sample rates are specified in million samples per second (Msample/s). Gbps, Mcps, Mbps, Msps, kbps, ksps and Msample/s are not SI units.

Specifications

Frequency

Frequency range, RF input		
Phase noise, AM noise measurements	R&S®FSWP8	
	DC coupled (requires R&S®FSWP-B1 option)	1 MHz to 8 GHz
	AC coupled	1 MHz to 8 GHz
	R&S®FSWP26	
	DC coupled	1 MHz to 26.5 GHz
	AC coupled	10 MHz to 26.5 GHz
	R&S®FSWP50	
	DC coupled	1 MHz to 50 GHz
	AC coupled	10 MHz to 50 GHz
Baseband noise measurements	see section Baseband noise measurement	
Frequency resolution		0.01 Hz
Reference frequency, internal		
Accuracy		± (time since last adjustment × aging rate + temperature drift + calibration accuracy)
Aging per year	standard	$\pm 1 \times 10^{-7}$
	with R&S®FSWP-B4 OCXO precision frequency reference option	
	first year of operation	$\pm 5 \times 10^{-8}$
	after first year of operation	$\pm 3 \times 10^{-8}$
Temperature drift	0 °C to +50 °C	$\pm 1 \times 10^{-9}$
Achievable initial calibration accuracy	standard	$\pm 1 \times 10^{-8}$
	with R&S®FSWP-B4 OCXO precision frequency reference option	$\pm 5 \times 10^{-9}$

Phase noise measurements

Measurement results		SSB phase noise, spurious signals, integrated RMS phase deviation, residual FM, time jitter
Offset frequency range	carrier frequency ≤ (maximum input frequency – 1 GHz)	1 µHz to max. input frequency – carrier frequency
	carrier frequency ≥ (maximum input frequency – 1 GHz)	1 µHz to 1 GHz
Signal level range	level setting = high	–20 dBm to +30 dBm
	level setting = low	–40 dBm to +30 dBm
Number of traces		6
Phase noise measurement uncertainty	DUT phase noise ≥ 15 dB above phase noise sensitivity of R&S®FSWP [1]	
	10 mHz ≤ offset < 1 MHz	< 1.5 dB
	1 MHz ≤ offset ≤ 30 MHz	< 2 dB
	30 MHz < offset	< 3 dB
Level measurement uncertainty	–20 dBm ≤ signal level ≤ 15 dBm, +20 °C to +30 °C	
	1 MHz ≤ signal frequency < 8 GHz	< 1 dB
	8 GHz ≤ signal frequency < 18 GHz	< 2 dB
	18 GHz ≤ signal frequency	< 3 dB
Spurious level [2]	f_{in} < 1 GHz	
	10 Hz ≤ offset from carrier < 1 kHz	< –90 dBc
	1 kHz ≤ offset from carrier ≤ 30 MHz	< –100 dBc
	f_{in} ≥ 1 GHz	
	10 Hz ≤ offset from carrier < 1 kHz	< –90 dBc + 20 log(f_{in}/GHz)
	1 kHz ≤ offset from carrier ≤ 30 MHz	< –100 dBc + 20 log(f_{in}/GHz)
AM suppression	10 mHz < offset < 1 MHz	40 dB (nom.)
	1 MHz ≤ offset ≤ 30 MHz, level setting = high and internal mixer capture range = narrow or wide	30 dB (nom.)
	1 MHz ≤ offset ≤ 10 MHz, level setting = low or external mixer capture range = narrow or wide	30 dB (nom.)

[1] Specified values for offset frequencies ≤ 30 % of signal frequency. With the R&S®FSWP-B60 or R&S®FSWP-B61 option the phase noise sensitivity improvement due to the number of cross-correlations is included. For DUT phase noise between 6 dB and 15 dB above phase noise sensitivity of the R&S®FSWP, add 1 dB of uncertainty.

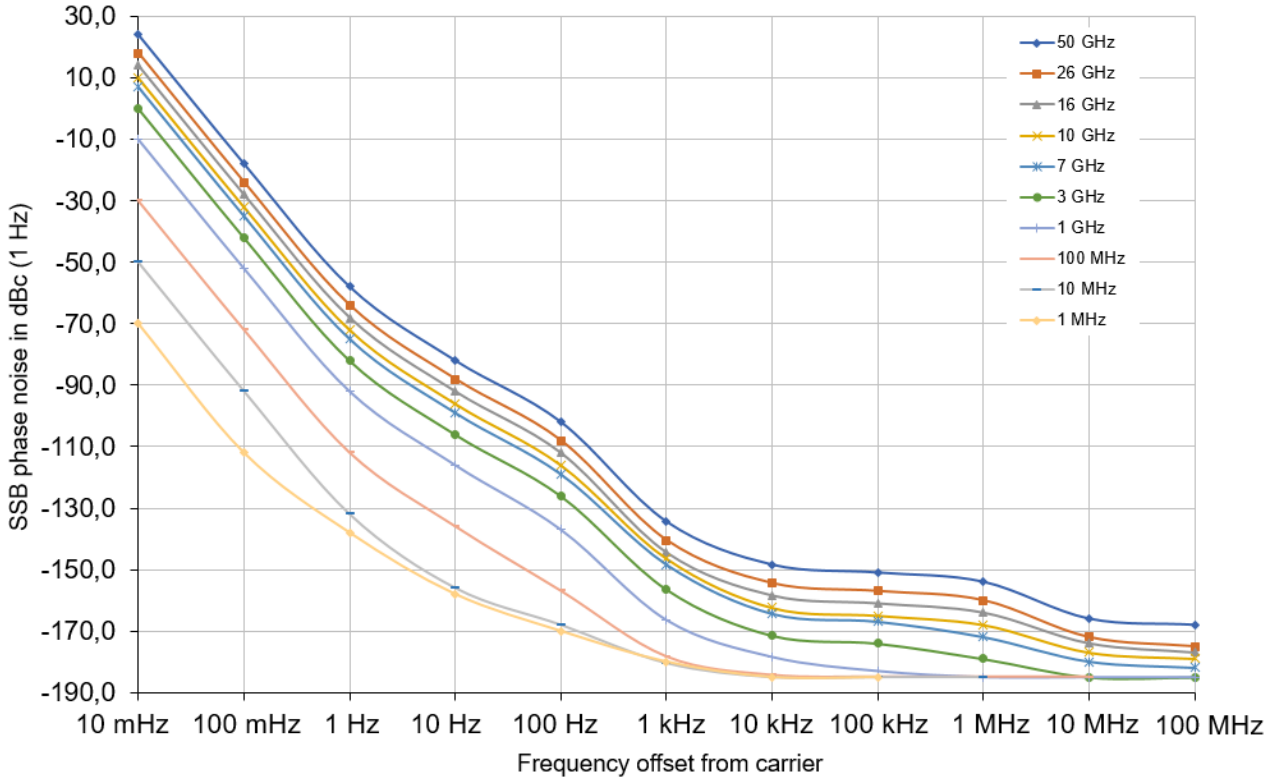
[2] Specified values for offset frequencies ≤ 30 % of signal frequency. For offset frequencies > 30 MHz spurious levels are not warranted but meet typically the same specification as for 30 MHz offset.

Phase noise sensitivity with R&S®FSWP-B61 cross-correlation (low phase noise) option [3]

For offset frequencies ≥ 1 Hz start offset = 1 Hz, for offset frequencies < 1 Hz start offset = 0.01 Hz, correlation factor = 1, frequency reference internal, internal reference loop bandwidth 30 Hz, signal level ≥ 10 dBm [4], for instruments with R&S®FSWP-B64 option: signal source output = off, for sensitivity with signal source = on, see section R&S®FSWP-B64 additive phase noise measurements, SSB phase noise specified values in dBc (1 Hz),

RF input frequency	Offset frequency from the carrier										
	0.01 Hz	0.1 Hz	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz	30 MHz
1 MHz	–60	–105	–118	–136	–148	–166	–176	–176			
10 MHz	–40	–86	–115	–132	–142	–160	–170	–170	–170		
100 MHz	–20	–66	–95	–117	–140	–166	–170	–173	–175	–175	–175
1 GHz	0	–46	–75	–97	–120	–150	–166	–173	–173	–173	–173
3 GHz	+10	–36	–65	–87	–110	–140	–156	–158	–163	–170	–170
7 GHz	+17	–29	–58	–80	–103	–133	–152	–153	–157	–166	–166
10 GHz	+20	–26	–55	–77	–100	–133	–152	–153	–157	–173	–175
16 GHz	+24	–22	–51	–73	–96	–129	–148	–149	–153	–170	–171
26 GHz	+28	–18	–47	–69	–92	–125	–144	–145	–149	–166	–167
50 GHz	+34	–12	–41	–63	–86	–119	–138	–139	–143	–160	–161

Improvement of phase noise sensitivity by number of correlations (with R&S®FSWP-B61 [5] option)				
Offset frequencies ≥ 1 Hz [6]				
Correlations	10	100	1000	10 000
Improvement	5 dB	10 dB	15 dB	20 dB



Typical phase noise at different center frequencies with R&S®FSWP-B61 option (start offset = 10 mHz)

[3] The specifications in this table apply to instruments starting with the following serial numbers: R&S®FSWP8: 101378, R&S®FSWP26: 101740, R&S®FSWP50: 101539.

[4] For signal levels below +10 dBm, the phase noise sensitivity is limited by the thermal noise floor of –177 dBm (1 Hz).

[5] Without the R&S®FSWP-B60/R&S®FSWP-B61 option, the impact of cross-correlation is limited by the residual phase noise of the R&S®FSWP local oscillators (1 set only). Therefore the phase noise does not improve with increasing number of correlations as indicated in this table. Instead the specifications indicated in section Phase noise sensitivity without R&S®FSWP-B60/R&S®FSWP-B61 options apply.

[6] For offset frequencies below 1 Hz, the improvement impact of correlation is limited by the coupling between the two R&S®FSWP local oscillators. The improvement achievable in this case ranges from 15 dB (nom.) at 0.1 Hz frequency offset to 3 dB (nom.) at a frequency offset ≤ 30 mHz.

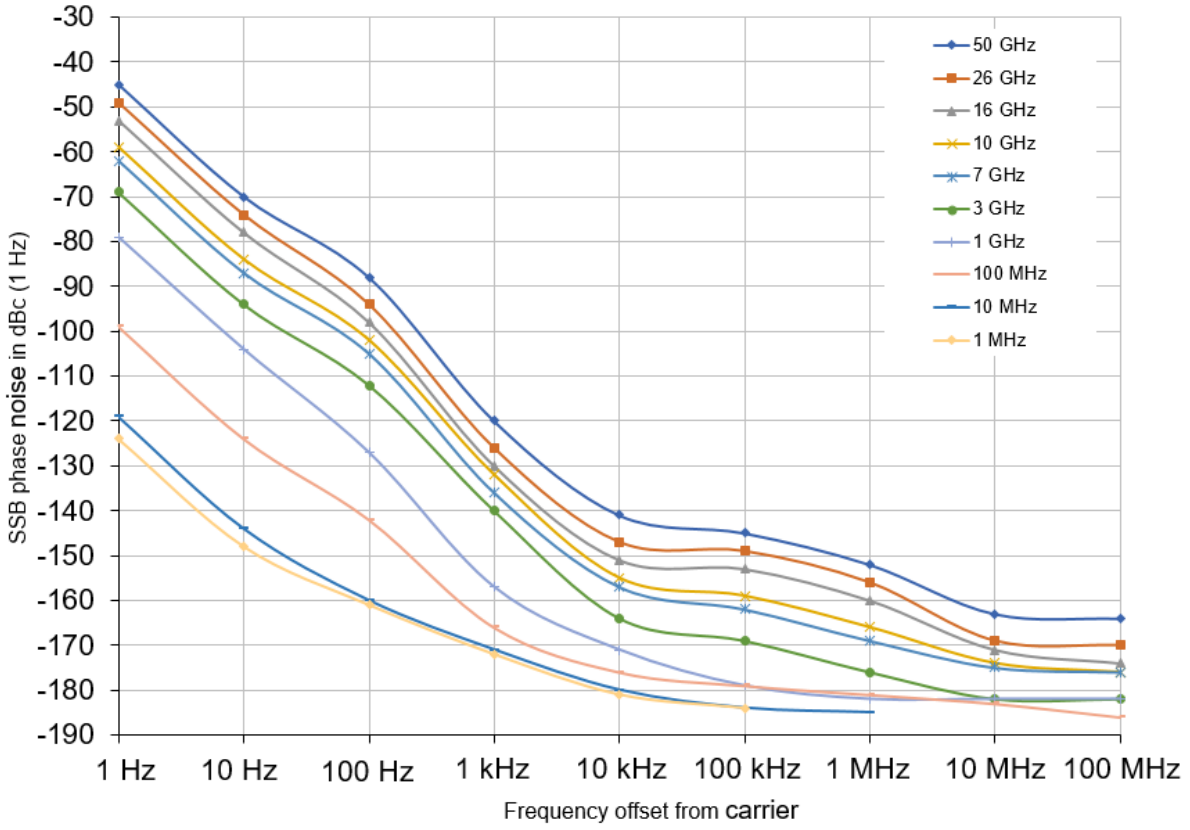
Phase noise sensitivity with R&S®FSWP-B60 cross-correlation option

Start offset 1 Hz, correlation factor = 1, frequency reference internal, signal level ≥ 10 dBm [4], without R&S®FSWP-B4 option,
for instruments with R&S®FSWP-B64 option: signal source output = off,
for sensitivity with signal source = on, see section R&S®FSWP-B64 additive phase noise measurements,
specified values in dBc (1 Hz),

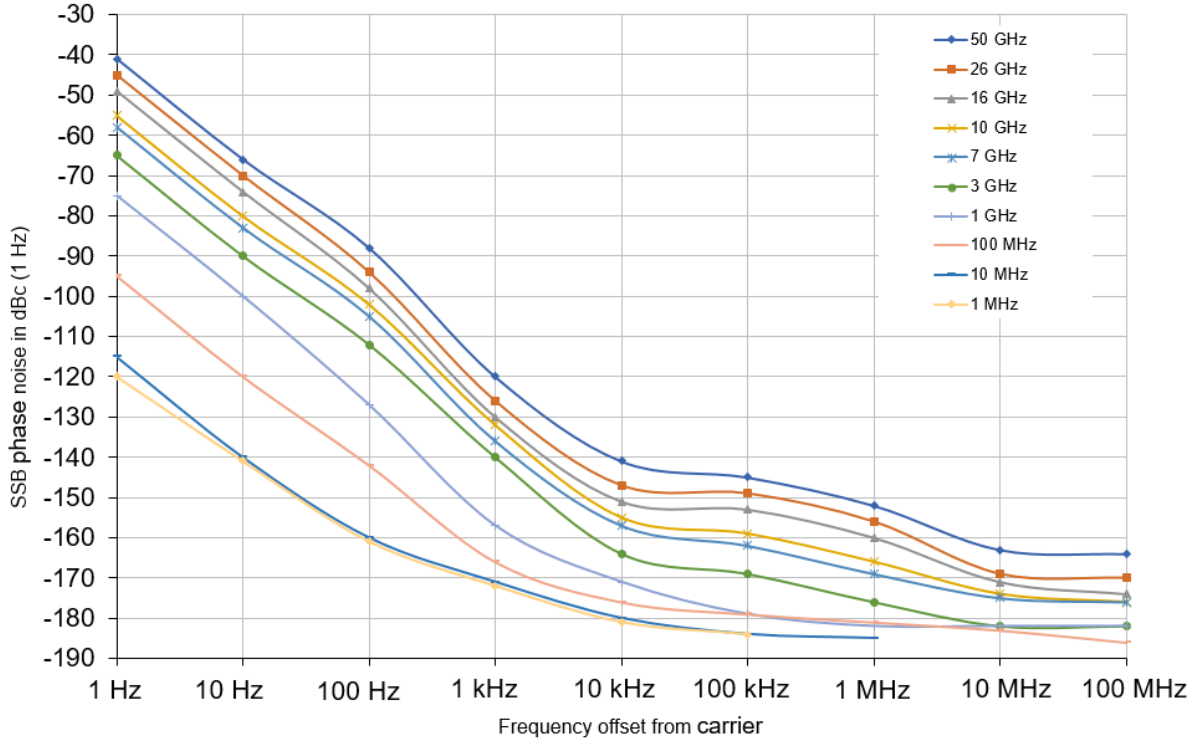
RF input	**Offset frequency from the carrier**								
frequency	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz	30 MHz
1 MHz	–118	–136	–148	–166	–176	–176			
10 MHz	–106	–130	–140	–158	–170	–170	–170		
100 MHz	–86	–116	–136	–163	–170	–173	–175	–175	–175
1 GHz	–66	–96	–116	–143	–166	–173	–173	–173	–173
3 GHz	–56	–86	–106	–133	–156	–158	–163	–170	–170
7 GHz	–49	–79	–99	–130	–152	–153	–157	–166	–166
10 GHz	–46	–76	–96	–128	–147	–150	–155	–173	–173
16 GHz	–42	–64	–92	–124	–143	–146	–151	–170	–170
26 GHz	–38	–60	–88	–120	–139	–142	–147	–166	–166
50 GHz	–32	–54	–82	–114	–133	–136	–141	–160	–160

R&S®FSWP-B4 option improves the phase noise sensitivity at 1 Hz and 10 Hz offsets by 5 dB (nom.).
At other offsets the above specification applies.

Improvement of phase noise sensitivity by number of correlations (with R&S®FSWP-B60 [5] option)				
Offset frequencies ≥ 1 Hz [6]				
Correlations	10	100	1000	10 000
Improvement	5 dB	10 dB	15 dB	20 dB



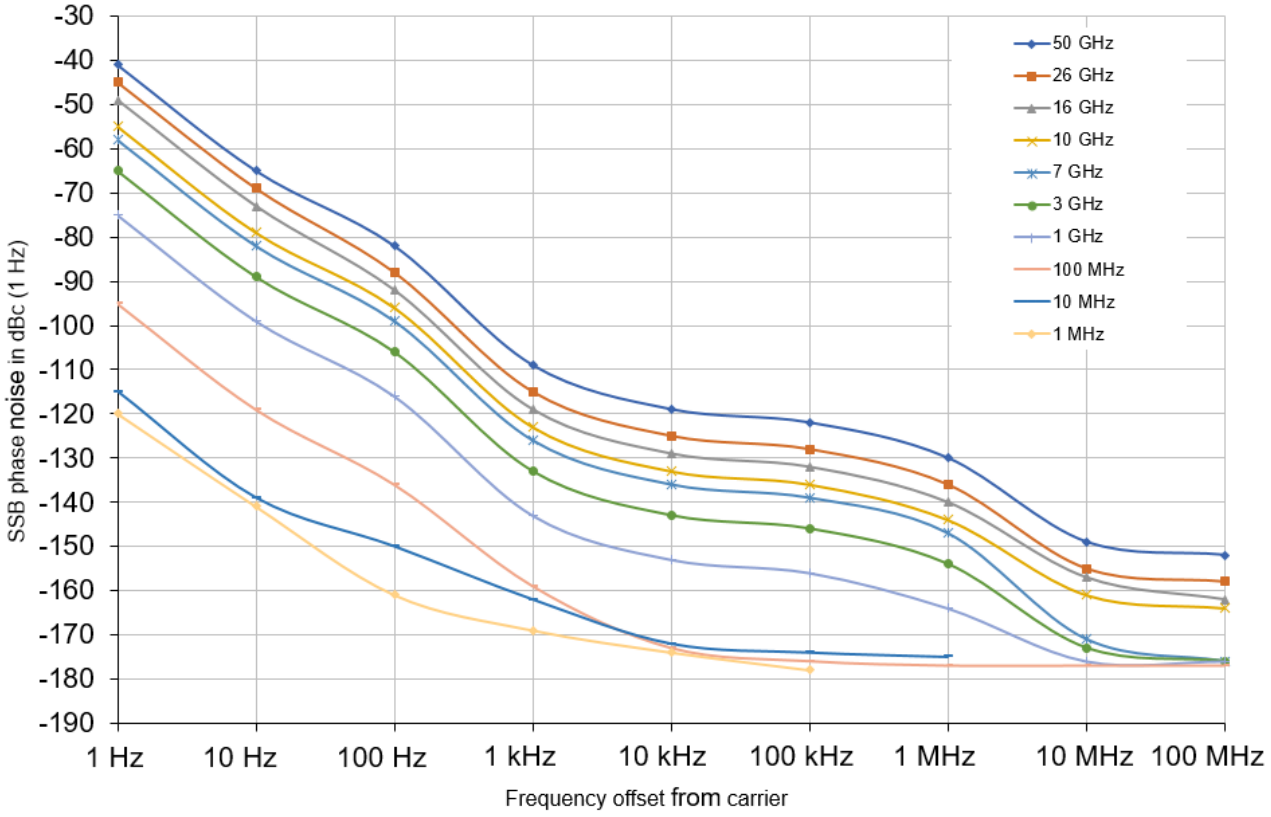
Typical phase noise at different center frequencies with R&S®FSWP-B60 and R&S®FSWP-B4 options (start offset = 1 Hz)



Typical phase noise at different center frequencies with R&S®FSWP-B60 option (start offset = 1 Hz)

Phase noise sensitivity without R&S®FSWP-B60/R&S®FSWP-B61 options

Start offset 1 Hz, correlation factor = 1, frequency reference internal, signal level ≥ 10 dBm [4], without R&S®FSWP-B4 option, specified values in dBc (1 Hz),									
RF input frequency	**Offset frequency from the carrier**								
	1 Hz (nom.)	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz	30 MHz
1 MHz	–100	–122	–138	–155	–168	–168			
10 MHz	–100	–122	–138	–155	–168	–168	–168		
100 MHz	–80	–102	–130	–155	–167	–170	–170	–170	–170
1 GHz	–60	–82	–110	–135	–147	–150	–157	–170	–170
3 GHz	–50	–72	–100	–125	–137	–140	–147	–167	–170
7 GHz	–43	–65	–93	–118	–130	–133	–140	–160	–163
10 GHz	–40	–62	–90	–115	–127	–130	–137	–157	–160
16 GHz	–36	–58	–86	–111	–123	–126	–133	–153	–156
26 GHz	–32	–54	–82	–107	–119	–122	–129	–149	–152
50 GHz	–26	–48	–76	–101	–113	–116	–123	–143	–146
R&S®FSWP-B4 option improves the phase noise sensitivity at 1 Hz offset by 10 dB (nom.). At other offsets the above specification applies.									



Typical phase noise at different center frequencies with R&S®FSWP-B4 option

Measurement speed, nominal values

The measurement times in the table below apply to the following conditions:
auto frequency = off, half decade config = auto, RBW = 10 %, correlation factor ≥ 10 and measurement times ≥ 2 s.
Measurement times normalized to correlation factor = 1.

Time per correlation	span	
	0.1 Hz to 100 MHz	27 s
	1 Hz to 100 MHz	6.7 s
	10 Hz to 100 MHz	0.8 s
	100 Hz to 100 MHz	0.1 s
	1 kHz to 100 MHz	0.01 s
	10 kHz to 100 MHz	0.001 s

To obtain the measurement time for a given number of correlations (without automatic signal frequency search), multiply the above figures by the number of correlations.

AM noise measurements

Offset frequency range	input signal ≤ 100 MHz	10 mHz to 30 % of carrier frequency
	input signal > 100 MHz	10 mHz to 30 MHz
AM noise measurement uncertainty	10 mHz < offset < 1 MHz	< 2 dB
	1 MHz ≤ offset ≤ 30 MHz	< 2.5 dB
Level measurement uncertainty	–20 dBm ≤ signal level ≤ +15 dBm, +20 °C to +30 °C	
	1 MHz ≤ signal frequency < 8 GHz	< 1 dB
	8 GHz ≤ signal frequency < 18 GHz	< 2 dB
	18 GHz ≤ signal frequency	< 3 dB

AM noise sensitivity

Start offset 1 Hz, correlations = 1, signal level ≥ 10 dBm [4], specified values in dBc (1 Hz), for typical values subtract 6 dB									
RF input	**Offset frequency from the carrier**								
frequency	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz	30 MHz
100 MHz ≤ f ≤ 1 GHz	–105	–120	–135	–150	–158	–165	–165	–165	–165
1 GHz < f ≤ 12 GHz	–100	–115	–130	–145	–155	–160	–165	–165	–165
12 GHz < f ≤ 18 GHz	–90	–105	–120	–135	–150	–160	–165	–165	–165
18 GHz < f ≤ 33 GHz	–80	–95	–110	–125	–140	–150	–160	–165	–165
33 GHz < f ≤ 50 GHz	–70	–85	–100	–115	–130	–140	–150	–160	–160

Improvement of AM noise sensitivity by number of correlations				
Correlations	10	100	1000	10 000
Improvement	5 dB	10 dB	15 dB	20 dB

Baseband noise measurement

Frequency range	R&S®FSWP8	
	RF input, AC coupled	1 MHz to 8 GHz
	RF input, DC coupled (R&S®FSWP-B1 required)	10 mHz to 8 GHz
	baseband input	10 mHz to 30 MHz
	R&S®FSWP26	
	RF input, AC coupled	1 MHz to 26.5 GHz
	RF input, DC coupled (R&S®FSWP-B1 required)	10 mHz to 26.5 GHz
	baseband input	10 mHz to 30 MHz
	R&S®FSWP50	
	RF input, AC coupled	10 MHz to 50 GHz
	RF input, DC coupled (R&S®FSWP-B1 required)	10 mHz to 8 GHz
	baseband input	10 mHz to 30 MHz
Level measurement range	RF input	< +8 dBm
	baseband input	< +4 dBm
Level measurement uncertainty	+20 °C to +30 °C	
	10 mHz < f_{in} < 1 MHz	< 2 dB (nom.)
	1 MHz ≤ f_{in} ≤ 30 MHz	< 2.5 dB (nom.)
Units		dBm (1 Hz), dBµV (1 Hz), dBV (1 Hz), V ($\sqrt{Hz}$)

Baseband noise level

Start offset 1 Hz, correlation factor = 1, input = baseband input, 50 Ω terminated, specified values in dBm (1 Hz), numbers in brackets are typical values in dBc (1 Hz).									
Input frequency	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz	30 MHz
Noise level	–120 (–126)	–130 (–136)	–145 (–151)	–154 (–160)	–160 (–166)	–160 (–166)	–160 (–170)	–160 (–170)	–160 (–170)

VCO characterization measurements (frequency, RF power, DC supply current)

Sweep parameters		DC tune voltage (V_{tune})
		DC auxiliary voltage (V_{aux})
		DC supply voltage (V_{supply})
		DC supply current (I_{supply})
Measurement parameters		frequency
		RF power
		DC supply current
		tuning sensitivity
Frequency resolution		100 mHz to 100 kHz in steps of 1, 10, …
RF power measurement range	1 MHz ≤ signal frequency ≤ 100 MHz	–15 dBm to +27 dBm
	signal frequency > 100 MHz	–20 dBm to +27 dBm
Level measurement uncertainty	–20 dBm ≤ signal level ≤ 15 dBm, +20 °C to +30 °C	
	1 MHz ≤ signal frequency < 8 GHz	< 1 dB
	8 GHz ≤ signal frequency < 18 GHz	< 2 dB
	signal frequency ≥ 18 GHz	< 3 dB
V_{tune}	setting range	–10 V to +28 V
	setting resolution	0.75 mV
	setting uncertainty	±(0.2 % of reading + 8 mV) (meas.)
	reading uncertainty	±(0.5 % of reading + 25 mV) (meas.)
	output resistance	50 Ω
	output settling time	7 ms/V
	noise level	< 1 nV (RMS) at 10 kHz (meas.)
V_{aux}	setting range	–10 V to +10 V
	setting resolution	0.5 mV
	setting uncertainty	±(0.1 % of reading + 2 mV) (meas.)
	reading uncertainty	±(0.5 % of reading + 25 mV) (meas.)
	output resistance	5 Ω
	output settling time	1 ms/V
	noise level	< 10 nV (RMS) at 10 kHz (meas.)
V_{supply}	setting range	0 to 16 V
	setting resolution	0.3 mV
	setting uncertainty	±(0.1 % of reading + 1 mV) (meas.)
	reading uncertainty	±(0.5 % of reading + 25 mV) (meas.)
	output resistance	0.5 Ω
	output settling time	50 ms/V
	noise level	< 10 nV (RMS) at 10 kHz (meas.)
I_{supply}	setting range	10 mA to 2000 mA
	setting resolution	50 µA
	setting uncertainty	±(0.5 % of reading + 0.5 mA) (meas.)
	reading uncertainty	±(0.5 % of reading + 1.5 mA) (meas.)

Transient analysis

Frequency range	R&S®FSWP8	
	DC coupled (requires R&S®FSWP-B1 option)	1 MHz to 8 GHz
	AC coupled	1 MHz to 8 GHz
	R&S®FSWP26	
	DC coupled	1 MHz to 26.5 GHz
	AC coupled	10 MHz to 26.5 GHz
	R&S®FSWP50	
	DC coupled	1 MHz to 50 GHz
	AC coupled	10 MHz to 50 GHz
Measurement parameters	narrow mode/wide mode	frequency
	narrow mode additionally	phase
Frequency transient bandwidth	narrow mode	40 MHz
	wide mode	256 MHz to 8 GHz
Frequency uncertainty		±(resolution + reference frequency accuracy)
Phase uncertainty	DUT signal locked to target frequency	0.05° + 0.1°/GHz
RF input level range	narrow mode	−20 dBm to +20 dBm
	wide mode	
	256 MHz to 6 GHz	−15 dBm to +20 dBm
	6 GHz to 7 GHz	−10 dBm to +20 dBm
	7 GHz to 8 GHz	0 dBm to +20 dBm
Time span		1 µs to 16 s
Time resolution		> 20 ns
Measurement trigger	trigger mode	free run, external, frequency
	external trigger polarity	positive, negative (3.3 V TTL level)
	pretrigger delay	(–1) × time span to 16 s

Frequency resolution, narrow mode

Observation time	1 µs	10 µs	100 µs	1 ms	10 ms	100 ms	1 s	10 s	16 s
Min. VBW	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz
Max. VBW	5 MHz	5 MHz	5 MHz	5 MHz	625 kHz	96 kHz	10 kHz	1 kHz	625 Hz
Measurement points	51	501	5001	50001	62501	100001	100001	100001	100001
Time resolution at max. VBW	20 ns	20 ns	20 ns	20 ns	160 ns	1 µs	10 µs	100 µs	160 µs
Frequency resolution at min. VBW for span > 1 MHz	20 Hz	20 Hz	20 Hz	20 Hz	20 Hz	20 Hz	20 Hz	20 Hz	20 Hz
Frequency resolution at min. VBW for span ≤ 1 MHz	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz
Frequency resolution at max. VBW	57 kHz	57 kHz	57 kHz	57 kHz	1.2 kHz	500 Hz	30 Hz	30 Hz	30 Hz

Frequency resolution, wide mode (256 MHz to 8 GHz)

Observation time	1 µs	10 µs	100 µs	1 ms	10 ms	100 ms	1 s	10 s	16 s
Min. VBW	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz
Max. VBW	100 kHz	100 kHz	100 kHz	100 kHz	100 kHz	96 kHz	10 kHz	1 kHz	625 Hz
Measurement points	51	501	5001	50001	62501	100001	100001	100001	100001
Time resolution at max. VBW	20 ns	20 ns	20 ns	20 ns	160 ns	1 µs	10 µs	100 µs	160 µs
Frequency resolution at min. VBW	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz	1 Hz
Frequency resolution at max. VBW	15 MHz	15 MHz	1 MHz	20 kHz	20 kHz	5 kHz	250 Hz	20 Hz	20 Hz

Allan deviation, Allan variance

Frequency range	R&S®FSWP8	1 MHz to 8 GHz
	R&S®FSWP26	1 MHz to 26.5 GHz
	R&S®FSWP50	1 MHz to 50 GHz
Measurement range	τ	100 ns to 1 000 000 s
Allan deviation	reference frequency internal and with R&S®FSWP-B61 option	1.0×10^{-13} at τ = 1 s (nom.)
		1.1×10^{-11} at τ = 1000 s (nom.)
	reference frequency with highly stable external reference, reference loop bandwidth 100 Hz	8.8×10^{-14} at τ = 1 s (nom.)
		7.0×10^{-15} at τ = 1000 s (nom.)

Inputs and outputs

RF input		
Impedance		50 Ω
Connector	R&S®FSWP8	N female
	R&S®FSWP26	APC 3.5 mm male (compatible with SMA)
	R&S®FSWP50	1.85 mm male (compatible with 2.4 mm)
VSWR of R&S®FSWP8		
without R&S®FSWP-B1 option	10 MHz ≤ f < 3 GHz	1.5 (nom.)
	3 GHz ≤ f ≤ 8 GHz	2.0 (nom.)
with R&S®FSWP-B1 option	RF attenuation ≤ 4 dB	
	10 MHz ≤ f ≤ 8 GHz	typ. 1.87 [7]
	5 dB ≤ RF attenuation ≤ 9 dB	
	10 MHz ≤ f < 1 GHz	< 1.5, typ. 1.20 [7]
	1 GHz ≤ f < 3.6 GHz	< 1.5, typ. 1.31 [7]
	3.6 GHz ≤ f ≤ 8 GHz	< 2.0, typ. 1.51 [7]
	RF attenuation ≥ 10 dB	
	10 MHz ≤ f < 1 GHz	< 1.2, typ. 1.09 [7]
	1 GHz ≤ f < 3.6 GHz	< 1.5, typ. 1.19 [7]
	3.6 GHz ≤ f ≤ 8 GHz	< 2.0, typ. 1.42 [7]
VSWR of R&S®FSWP26, R&S®FSWP50	RF attenuation ≤ 4 dB	
	10 MHz ≤ f ≤ 26.5 GHz	typ. 1.87 [7]
	26.5 GHz < f ≤ 40 GHz	typ. 2.0 [7]
	40 GHz < f ≤ 50 GHz	2.0 (nom.)
	5 dB ≤ RF attenuation ≤ 9 dB	
	10 MHz ≤ f ≤ 3.5 GHz	< 1.5, typ. 1.24 [7]
	3.5 GHz < f ≤ 8 GHz	< 1.8, typ. 1.26 [7]
	8 GHz < f ≤ 18 GHz	< 1.8, typ. 1.39 [7]
	18 GHz < f ≤ 26.5 GHz	< 2.0, typ. 1.43 [7]
	26.5 GHz < f ≤ 40 GHz	< 2.5, typ. 1.8 [7]
	40 GHz < f ≤ 50 GHz	2.0 (nom.)
	RF attenuation ≥ 10 dB	
	10 MHz ≤ f ≤ 3.5 GHz	< 1.2, typ. 1.12 [7]
	3.5 GHz < f ≤ 8 GHz	< 1.5, typ. 1.19 [7]
	8 GHz < f ≤ 18 GHz	< 1.5, typ. 1.25 [7]
	18 GHz < f ≤ 26.5 GHz	< 2.0, typ. 1.37 [7]
	26.5 GHz < f ≤ 40 GHz	< 2.5, typ. 1.7 [7]
	40 GHz < f ≤ 50 GHz	2.0 (nom.)
Setting range of attenuator	R&S®FSWP8	
	without R&S®FSWP-B1 option	no user accessible attenuator
	with R&S®FSWP-B1 option	0 dB to 75 dB, in 5 dB steps [8]
	R&S®FSWP26, R&S®FSWP50	0 dB to 75 dB, in 5 dB steps [8]

[7] Typical VSWR performance: performance expected to be met in 95 % of the cases with a confidence level of 95 %, temperature range +20 °C to +30 °C, input set to DC coupling. These values are not warranted and are subject to modification if a significant change in the statistical behavior of production instruments is observed.

[8] With R&S®FSWP-B1 option in spectrum analyzer mode: 0 dB to 79 dB, mechanical RF attenuator: 5 dB steps, electronic IF attenuator: 1 dB steps.

Maximum RF input level		
DC voltage	AC coupled	50 V
	DC coupled	0 V
CW RF power	R&S®FSWP8 without R&S®FSWP-B1 option	
	input frequency < 5 MHz	20 dBm (= 0.1 W)
	input frequency ≥ 5 MHz	30 dBm (= 1 W)
	R&S®FSWP8 with R&S®FSWP-B1 option, R&S®FSWP26, R&S®FSWP50	
	RF attenuation = 0 dB	20 dBm (= 0.1 W)
	RF attenuation ≥ 10 dB	30 dBm (= 1 W)
Pulse spectral density	RF attenuation = 0 dB, RF preamplifier off	97 dB µV/MHz
Maximum pulse voltage	R&S®FSWP8 without R&S®FSWP-B1 option	
	any hardware setting	50 V
	R&S®FSWP26, FSWP50, R&S®FSWP8 with R&S®FSWP-B1 option	
	RF attenuation < 10 dB	50 V
	RF attenuation ≥ 10 dB	150 V
Maximum pulse energy, pulse duration τ = 10 µs	R&S®FSWP8 without R&S®FSWP-B1 option	
	any hardware setting	0.5 mWs
	R&S®FSWP26, R&S®FSWP50, R&S®FSWP8 with R&S®FSWP-B1 option	
	RF attenuation ≥ 10 dB	1 mWs

V_{supply}		
Connector		BNC female
Impedance		50 Ω (nom.)
Output voltage		0 V to 16 V
Output current		0 mA to 2000 mA

V_{aux}		
Connector		BNC female
Impedance		50 Ω (nom.)
Output voltage		–10 V to +10 V
Output current		±100 mA

V_{tune}		
Connector		BNC female
Impedance		50 Ω (nom.)
Output voltage		–10 V to +28 V
Output current		±20 mA

Baseband input channel 1		
Connector		BNC female
Impedance		50 Ω (nom.)
Input frequency range		DC to 30 MHz
Maximum input level		±2 V

Baseband input channel 2		
Connector		BNC female
Impedance		50 Ω (nom.)
Input frequency range		DC to 30 MHz
Maximum input level		±2 V

Probe power supply		
Supply voltages		+15 V DC, –12.6 V DC and ground, max. 150 mA (nom.)

Noise source control		
Connector		BNC female
Output voltage		0 V/28 V, max. 100 mA, switchable (nom.)

Trigger in/out		
Connector		BNC female
Impedance		50 Ω (nom.)

Power sensor		
Connector		6-pin LEMOSA female for R&S®NRP-Zxx power sensors

Reference input 1 MHz to 50 MHz		
Connector		BNC female
Impedance		50 Ω (nom.)
Input frequency range		1 MHz ≤ f_{in} ≤ 50 MHz, in 1 Hz steps
Required level		> 0 dBm

Reference input 100 MHz/1 GHz		
Connector		SMA female
Impedance		50 Ω (nom.)
Input frequency range		100 MHz, 1 GHz
Required level		0 dBm to 10 dBm

Reference output 10 MHz								
Connector					BNC female			
Impedance					50 Ω (nom.)			
Output frequency					10 MHz			
Level					10 dBm (nom.)			
Nominal phase noise with R&S®FSWP-B61 or R&S®FSWP-B4 option, internal reference loop bandwidth 30 Hz								
Offset frequency from the carrier	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	3 MHz
Phase noise in dBc (1 Hz)	–110	–134	–146	–157	–165	–166	–167	–168

Reference output 1 MHz to 50 MHz		
Connector		BNC female
Impedance		50 Ω (nom.)
Output frequency	internal reference	not active
	external reference	same as reference input signal
Level		same as reference input signal

Reference output 100 MHz								
Connector					SMA female			
Impedance					50 Ω (nom.)			
Output frequency					100 MHz			
Level					6 dBm (nom.)			
Nominal phase noise with R&S®FSWP-B61 or R&S®FSWP-B4 option, internal reference loop bandwidth 30 Hz								
Offset frequency from the carrier	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz
Phase noise in dBc (1 Hz)	–91	–116	–133	–154	–162	–163	–164	–164

Reference output 640 MHz								
Connector					SMA female			
Impedance					50 Ω (nom.)			
Output frequency					640 MHz			
Level					16 dBm (nom.)			
Nominal phase noise with R&S®FSWP-B61 or R&S®FSWP-B4 option, internal reference loop bandwidth 30 Hz								
Offset frequency from the carrier	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz
Phase noise in dBc (1 Hz)	–77	–101	–117	–145	–160	–165	–166	–167

IF/video output (only supported with R&S®FSWP-B1 option in spectrum analyzer mode)		
Connector		BNC female, 50 Ω (nom.)
IF out		
Bandwidth		equal to RBW setting
IF frequency		(RBW/2) to (240 MHz – RBW/2)
Output level	center frequency > 10 MHz, span = 0 Hz or I/Q analyzer on, signal at reference level and center frequency	0 dBm (nom.)
Video out		
Bandwidth		equal to VBW setting
Output scaling	log. display scale	logarithmic
	lin. display scale	linear
Output level	center frequency > 10 MHz, span = 0 Hz, signal at reference level and center frequency	1 V at 50 Ω load (nom.)

IEC/IEEE bus control		interface in line with IEC 625-2 (IEEE 488.2)
Command set		SCPI 1997.0
Connector		24-pin Amphenol female
Interface functions		SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C0

LAN interface		10/100/1000BASE-T
Connector		RJ-45

External monitor		
Connector		DVI-D, DisplayPort rev 1.1

USB interface		7 ports, type A plug, version 2.0
		1 port, type B plug, version 2.0

General data

Display		30.7 cm (12.1"), WXGA color touchscreen
Resolution		1280 × 800 pixel (WXGA resolution)
Pixel failure rate		$< 1 \times 10^{-5}$

Data storage		
Internal	standard	solid-state disk ≥ 128 Gbyte
External		supports USB 2.0 compatible memory devices

Temperature		
Operating temperature range		+5 °C to +50 °C
Permissible temperature range		0 °C to +55 °C
Storage temperature range		–40 °C to +70 °C
Climatic loading	without condensation	+40 °C at 90 % rel. humidity, in line with EN 60068-2-30

Altitude		
Maximum operating altitude	above sea level	4600 m (approx. 15100 ft)

Mechanical resistance		
Vibration	sinusoidal	5 Hz to 55 Hz, displacement: 0.15 mm constant, amplitude (1.8 g at 55 Hz), 55 Hz to 150 Hz, acceleration: 0.5 g constant, in line with EN 60068-2-6
	random	10 Hz to 300 Hz, acceleration 1.2 g (RMS), in line with EN 60068-2-64
Shock		40 g shock spectrum, in line with MIL-STD-810E, method no. 516.4, procedure I, MIL-PRF-28800F, class 3

EMC		in line with EMC Directive 2014/30/EU including: • IEC/EN 61326-1 [9, 10] • IEC/EN 61326-2-1 • CISPR 11/EN 55011 [9] • IEC/EN 61000-3-2 • IEC/EN 61000-3-3

Recommended calibration interval		1 year

Power supply		
Input voltage range	AC	100 V to 240 V
Supply frequency	AC	50 Hz to 60 Hz/400 Hz
Maximum input current		7.3 A to 4.6 A (100 V to 240 V)
Power consumption	R&S®FSWP8	
	without options	150 W
	with all options	250 W (meas.)
	R&S®FSWP26	
	without options	175 W
	with all options	275 W (meas.)
	R&S®FSWP50	
	without options	200 W
	with all options	300 W (meas.)
Safety		in line with: IEC 61010-1, EN 61010-1, UL 61010-1, CAN/CSA-C22.2 No. 61010-1
Test marks		VDE, CE, $_{C}$CSA$_{US}$, KCC

Dimensions and weight		
Dimensions (nom.)	W × H × D, including front handles and rear feet	462 mm × 240 mm × 504 mm (18.15 in × 9.44 in × 19.81 in)
Net weight (nom.)	R&S®FSWP8	
	without options	18.6 kg (41.01 lb)
	with all options	22 kg (48.5 lb)
	R&S®FSWP26, with all options	24 kg (52.9 lb)
	R&S®FSWP50, with all options	24.5 kg (54 lb)

[9] Emission limits for class A equipment.

[10] Immunity test requirement for industrial environment (EN 61326 table 2).

Options

R&S®FSWP-B1 spectrum analyzer

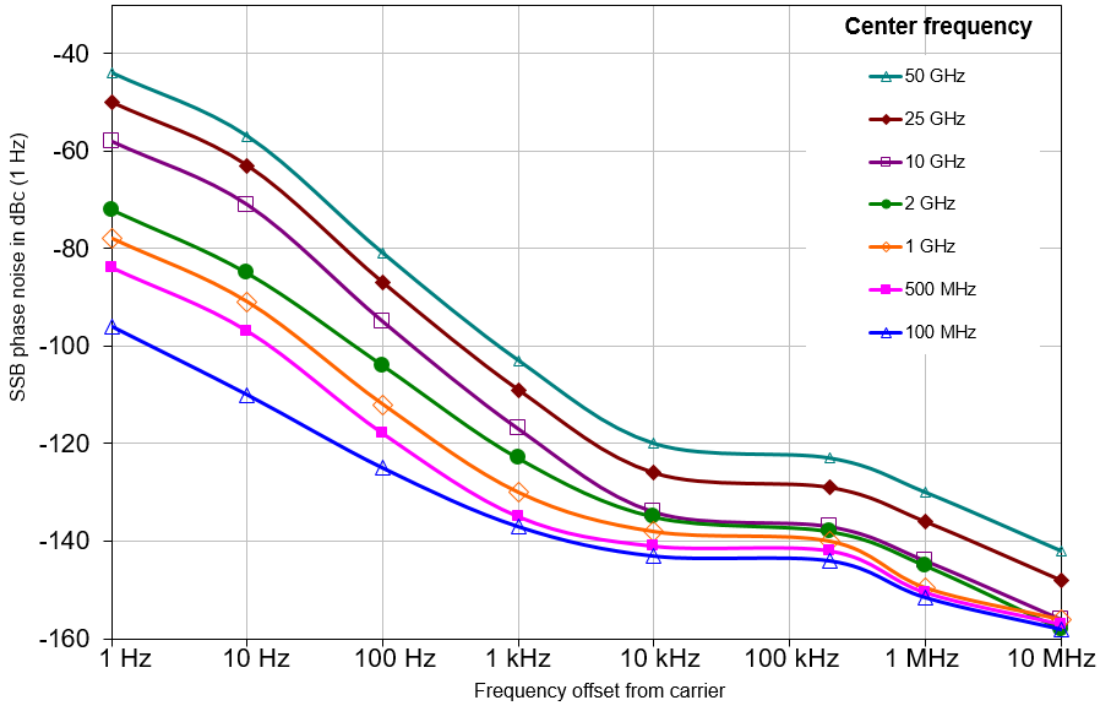
The following specifications apply for operation of the R&S®FSWP in spectrum analyzer mode unless otherwise stated.

Frequency

Frequency range	R&S®FSWP8	
	DC coupled	10 Hz to 8 GHz
	AC coupled	10 MHz to 8 GHz
	R&S®FSWP26	
	DC coupled	10 Hz to 26.5 GHz
	AC coupled	10 MHz to 26.5 GHz
	R&S®FSWP50	
	DC coupled	10 Hz to 50 GHz
	AC coupled	10 MHz to 50 GHz
Frequency resolution		0.01 Hz

Frequency readout		
Marker resolution		1 Hz
Uncertainty		±(marker frequency × reference accuracy + 10 % × resolution bandwidth + ½(span / (sweep points – 1)) + 1 Hz)
Number of sweep (trace) points	default value	1001
	range	101 to 100001
Marker tuning frequency step size	marker step size = sweep points	span / (sweep points – 1)
	marker step size = standard	span / (default sweep points – 1)
Frequency counter resolution		0.001 Hz
Count accuracy		±(frequency × reference accuracy + ½ (last digit))
Display range for frequency axis		0 Hz, 10 Hz to max. frequency
Resolution		0.1 Hz
Maximum span deviation		±0.1 %

Spectral purity		
SSB phase noise	frequency = 1000 MHz, carrier offset	
	10 Hz, without R&S®FSWP-B4 option	–80 dBc (1 Hz) (nom.)
	10 Hz, with R&S®FSWP-B4 option	–95 dBc (1 Hz) (nom.)
	100 Hz	–106 dBc (1 Hz), typ. –112 dBc (1 Hz)
	1 kHz	< –125 dBc (1 Hz), typ. –130 dBc (1 Hz)
	10 kHz	< –134 dBc (1 Hz), typ. –138 dBc (1 Hz)
	100 kHz	< –136 dBc (1 Hz), typ. –140 dBc (1 Hz)
	1 MHz	< –145 dBc (1 Hz), typ. –149 dBc (1 Hz)
	10 MHz	–156 dBc (1 Hz) (nom.)
Residual FM	frequency = 1000 MHz, RBW = 1 kHz, sweep time = 100 ms	< 0.1 Hz (nom.)



Typical phase noise at different center frequencies in spectrum analyzer mode (with R&S®FSWP-B4 option for offsets ≤ 10 Hz)

Sweep time

Sweep time range	span = 0 Hz	1 µs to 16000 s
	span ≥ 10 Hz	3 µs to 16000 s [11]
Sweep time accuracy	span = 0 Hz, sweep points ≤ 10001	±0.1 % (nom.)
	span ≥ 10 Hz	±3 % (nom.)

Resolution bandwidths

Sweep filters and FFT filters		
Resolution bandwidths (–3 dB)		1 Hz to 10 MHz in 1/2/3/5 sequence, 3.9 kHz, 6.25 kHz additionally
	with R&S®FSWP-B8E option	20 MHz, 40 MHz additionally
	with R&S®FSWP-B8 option	20 MHz, 40 MHz, 50 MHz, 80 MHz additionally
Bandwidth uncertainty		< 3 % (nom.)
Shape factor 60 dB:3 dB		< 5 (nom.)

Video bandwidths	standard	1 Hz to 10 MHz in 1/2/3/5 sequence
	with R&S®FSWP-B8E option	20 MHz, 40 MHz additionally [12]
	with R&S®FSWP-B8 option	20 MHz, 40 MHz, 50 MHz, 80 MHz additionally [12]

Signal analysis bandwidth	standard	10 MHz (nom.)
	with R&S®FSWP-B80 option	80 MHz (nom.)

[11] The selected sweep time is the net data acquisition time (without the extra time needed for hardware settling or FFT processing).

[12] For video bandwidth settings > 20 MHz, the video bandwidth filter is bypassed.

Level

Level display		
Display range		displayed noise floor up to +30 dBm
Logarithmic level axis		1 dB to 200 dB, in steps of 1/2/5
Linear level axis		10 % of reference level per level division, 10 divisions or logarithmic scaling
Number of traces		6
Trace detector		max. peak, min. peak, auto peak (normal), sample, RMS, average
Trace functions		clear/write, max. hold, min. hold, average, view
Setting range of reference level		–130 dBm to (–10 dBm + RF attenuation – RF preamplifier gain), in steps of 0.01 dB
Units of level axis	logarithmic level display	dBm, dBµV, dBmV, dBµA, dBpW
	linear level display	µV, mV, µA, mA, pW, nW

Intermodulation

1 dB compression of input mixer (two tone)	RF attenuation = 0 dB, RF preamplifier off	
	$f_{in} \leq 3$ GHz	+15 dBm (nom.)
	3 GHz < $f_{in} \leq 8$ GHz	+10 dBm (nom.)
	$f_{in} > 8$ GHz	+7 dBm (nom.)
	with R&S®FSWP-B24 option, RF attenuation = 0 dB, RF preamplifier on	
	$f_{in} \leq 3$ GHz	–13 dBm (nom.)
	3 GHz < $f_{in} \leq 8$ GHz	–20 dBm (nom.)
	$f_{in} > 8$ GHz	–23 dBm (nom.)
Third order intercept point (TOI)	RF attenuation = 0 dB, level = –15 dBm (both), $\Delta f > 5 \times$ RBW, YIG preselector on, RF preamplifier off	
	$f_{in} < 10$ MHz	28 dBm (meas.)
	10 MHz ≤ $f_{in} < 1$ GHz	> 25 dBm, typ. 30 dBm
	1 GHz ≤ $f_{in} < 3$ GHz	> 20 dBm, typ. 25 dBm [13]
	3 GHz ≤ $f_{in} < 8$ GHz	> 17 dBm, typ. 20 dBm
	8 GHz ≤ $f_{in} < 10$ GHz	> 8 dBm
	10 GHz ≤ $f_{in} \leq 50$ GHz	> 10 dBm
	R&S®FSWP8, R&S®FSWP26 with R&S®FSWP-B24 option, RF attenuation = 0 dB, level = –50 dBm (both), $\Delta f > 5 \times$ RBW, YIG preselector on, RF preamplifier on	
	10 MHz ≤ $f_{in} < 1$ GHz	–10 dBm (meas.)
	1 GHz ≤ $f_{in} < 8$ GHz	–13 dBm (meas.)
	8 GHz ≤ $f_{in} \leq 26.5$ GHz	–15 dBm (meas.)
	R&S®FSWP50 with R&S®FSWP-B24 option, RF attenuation = 0 dB, level = –55 dBm (both), $\Delta f > 5 \times$ RBW, YIG preselector on, RF preamplifier on	
	10 MHz ≤ $f_{in} < 1$ GHz	–5 dBm (meas.)
	1 GHz ≤ $f_{in} < 4$ GHz	–10 dBm (meas.)
	$f_{in} > 4$ GHz	–20 dBm (meas.)
Second harmonic intercept point (SHI)	RF attenuation = 0 dB, level = –5 dBm, YIG preselector on, RF preamplifier off	
	1 MHz < $f_{in} \leq 500$ MHz	45 dBm (meas.)
	500 MHz < $f_{in} < 1.5$ GHz [14]	> 47 dBm, typ. 56 dBm
	500 MHz < $f_{in} < 1.5$ GHz [15]	> 52 dBm, typ. 60 dBm
	1.5 GHz ≤ $f_{in} \leq 4$ GHz	> 62 dBm, typ. 70 dBm
	4 GHz < $f_{in} \leq 25$ GHz	65 dBm (meas.)
	with R&S®FSWP-B24 option, RF attenuation = 0 dB, level = –50 dBm, YIG preselector on, RF preamplifier on	
	50 MHz < $f_{in} \leq 21.75$ GHz	10 dBm (meas.)

[13] With R&S®FSWP-B13 highpass filter option, highpass off. With highpass on, the TOI degrades by 5 dB (nom.).

[14] Without R&S®FSWP-B13 highpass filter option or highpass off.

[15] With R&S®FSWP-B13 highpass filter option, highpass on.

Sensitivity

All noise level data in this section not marked as typical (typ.) or nominal (nom.) are specified values whose compliance is ensured by testing.

Displayed average noise level		
RF preamplifier off	RF attenuation = 0 dB, termination = 50 Ω, normalized to 1 Hz RBW, trace average, average mode log, sample detector, +5 °C to +40 °C	
	10 Hz ≤ f ≤ 100 Hz	–110 dBm
	100 Hz < f ≤ 1 kHz	–120 dBm
	1 kHz < f < 9 kHz	–135 dBm
	RF attenuation = 0 dB, termination = 50 Ω, log. scaling, normalized to 1 Hz RBW, RBW = 1 kHz, VBW = 1 Hz, +5 °C to +40 °C, YIG preselector on	
	9 kHz ≤ f ≤ 1 MHz	–145 dBm
	1 MHz < f ≤ 1 GHz	–149 dBm
	1 GHz < f < 3 GHz [16]	–150 dBm
	1 GHz < f < 3 GHz [17]	–153 dBm
	3 GHz ≤ f < 8 GHz	–150 dBm
	8 GHz ≤ f < 13.6 GHz	–148 dBm
	13.6 GHz ≤ f < 18 GHz	–147 dBm
	18 GHz ≤ f < 25 GHz	–145 dBm
	25 GHz ≤ f ≤ 34 GHz	–140 dBm
	34 GHz < f ≤ 40 GHz	–137 dBm
	40 GHz < f ≤ 43.5 GHz	–135 dBm
	43.5 GHz < f ≤ 47 GHz	–133 dBm
	47 GHz < f ≤ 49 GHz	–131 dBm
	49 GHz < f ≤ 50 GHz	–129 dBm
R&S®FSWP8 or R&S®FSWP26 with R&S®FSWP-B24 option and RF preamplifier = 30 dB	RF attenuation = 0 dB, termination = 50 Ω, log. scaling, normalized to 1 Hz RBW, RBW = 1 kHz, VBW = 1 Hz, +5 °C to +40 °C, YIG preselector on	
	100 kHz < f ≤ 60 MHz	–160 dBm
	60 MHz < f ≤ 3 GHz	–165 dBm
	3 GHz < f ≤ 8 GHz	–162 dBm
	8 GHz < f ≤ 18 GHz	–162 dBm
	18 GHz < f ≤ 23 GHz	–160 dBm
	23 GHz < f ≤ 26.5 GHz	–156 dBm
R&S®FSWP50 with R&S®FSWP-B24 option and RF preamplifier = 30 dB	RF attenuation = 0 dB, termination = 50 Ω, log. scaling, normalized to 1 Hz RBW, RBW = 1 kHz, VBW = 1 Hz, +5 °C to +40 °C, YIG preselector on	
	100 kHz < f ≤ 60 MHz	–160 dBm
	60 MHz < f ≤ 3 GHz	–165 dBm
	3 GHz < f ≤ 8 GHz	–160 dBm
	8 GHz < f ≤ 18 GHz	–162 dBm
	18 GHz < f ≤ 23 GHz	–160 dBm
	23 GHz < f ≤ 40 GHz	–156 dBm
	40 GHz < f ≤ 43 GHz	–152 dBm
	43 GHz < f ≤ 50 GHz	–146 dBm
Improvement with noise cancellation	for noise-like signals	
	100 kHz < f ≤ 43 GHz	13 dB (nom.)
	43 GHz < f ≤ 50 GHz	0 dB (nom.)

Spurious responses

Spurious responses	YIG preselector on for f ≥ 8 GHz, mixer level ≤ –10 dBm [18], sweep optimization: auto or dynamic	
Image response	f_{in} – 2 × 8997 MHz (1st IF)	< –90 dBc
	f_{in} – 2 × 1317 MHz (2nd IF)	< –90 dBc
	f_{in} – 2 × 37 MHz (3rd IF)	< –90 dBc
	f_{in} = external interfering signal frequency	
Intermediate frequency response	f_{in} = 1st IF (8997 MHz)	< –90 dBc
	f_{in} = 2nd IF (1317 MHz)	< –90 dBc
	f_{in} = 3rd IF (37 MHz)	< –90 dBc
	f_{in} = external interfering signal frequency	

[16] Without R&S®FSWP-B13 highpass filter option or highpass off.

[17] With R&S®FSWP-B13 highpass filter option, highpass on.

[18] Mixer level = signal level – RF attenuation + preamplifier gain.

Residual spurious response	RF attenuation = 0 dB, signal source of R&S®FSWP-B64 option (additive phase noise measurements) turned off	
	f ≤ 1 MHz	< –90 dBm
	1 MHz < f ≤ 8900 MHz	< –110 dBm
	8900 MHz < f ≤ 26.5 GHz	< –100 dBm
	26.5 GHz < f ≤ 50 GHz	< –100 dBm (nom.)
	f = receive frequency	
Local oscillators related spurious	signal source of R&S®FSWP-B64 option (additive phase noise measurements) turned off	
	f_{in} < 1 GHz	
	10 Hz ≤ offset from carrier < 200 Hz	< –90 dBc
	offset from carrier > 200 Hz	< –100 dBc
	f_{in} ≥ 1 GHz	
	10 Hz ≤ offset from carrier < 200 Hz	< –90 dBc + 20 log(f_{in}/GHz)
	offset from carrier > 200 Hz	< –100 dBc + 20 log(f_{in}/GHz)
Vibrational environmental stimuli	max. 0.21 g (RMS)	< –60 dBc + 20 log(f_{in}/GHz) (nom.)

Level measurement uncertainty

Absolute level uncertainty	RBW = 10 kHz, level = –10 dBm, reference level = –10 dBm, RF attenuation = 10 dB	
	f = 64 MHz	< 0.2 dB (σ = 0.07 dB)
Frequency response, referenced to 64 MHz, YIG preselector on	RF attenuation = 10/20/30/40 dB, RF preamplifier off, +20 °C to +30 °C	
	10 Hz ≤ f < 9 kHz	< 1 dB (nom.)
	9 kHz ≤ f < 10 MHz	< 0.45 dB (σ = 0.17 dB)
	10 MHz ≤ f < 3.6 GHz	< 0.3 dB (σ = 0.10 dB)
	3.6 GHz ≤ f ≤ 8 GHz	< 0.5 dB (σ = 0.17 dB)
	8 GHz < f < 22 GHz, span < 1 GHz	< 1.5 dB (σ = 0.50 dB)
	22 GHz ≤ f ≤ 26.5 GHz, span < 1 GHz	< 2 dB (σ = 0.67 dB)
	26.5 GHz < f ≤ 50 GHz, span < 1 GHz	< 2.5 dB (σ = 0.83 dB)
	any RF attenuation, +15 °C to +40 °C	
	10 Hz ≤ f < 9 kHz	< 1 dB (nom.)
	9 kHz ≤ f < 3.6 GHz	< 0.6 dB (σ = 0.20 dB)
	3.6 GHz ≤ f ≤ 8 GHz	< 0.8 dB (σ = 0.27 dB)
	8 GHz < f < 22 GHz, span < 1 GHz	< 2 dB (σ = 0.67 dB)
	22 GHz ≤ f ≤ 26.5 GHz, span < 1 GHz	< 2.5 dB (σ = 0.83 dB)
	26.5 GHz < f ≤ 50 GHz, span < 1 GHz	< 3 dB (σ = 1.0 dB)
	RF attenuation ≤ 20 dB, RF preamplifier on, +20 °C to +30 °C	
	10 MHz ≤ f < 3.6 GHz	< 0.6 dB (σ = 0.2 dB)
	3.6 GHz ≤ f ≤ 8 GHz	< 0.8 dB (σ = 0.27 dB)
	8 GHz < f < 22 GHz, span < 1 GHz	< 2 dB (σ = 0.67 dB)
	22 GHz ≤ f ≤ 26.5 GHz, span < 1 GHz	< 2.5 dB (σ = 0.83 dB)
	26.5 GHz < f ≤ 50 GHz, span < 1 GHz	< 3 dB (σ = 1.0 dB)
Frequency response, referenced to 64 MHz, YIG preselector off	RF attenuation = 10/20/30/40 dB, RF preamplifier off, +20 °C to +30 °C, electronic attenuator off	
	f < 8 GHz	same values as with preselector on
	8 GHz ≤ f < 22 GHz	< 1.5 dB (σ = 0.5 dB)
	22 GHz ≤ f ≤ 26.5 GHz	< 2 dB (σ = 0.6 dB)
	26.5 GHz < f ≤ 50 GHz, span < 1 GHz	< 2.5 dB (σ = 0.83 dB)
	any RF attenuation or electronic attenuator on, +15 °C to +40 °C	
	f < 8 GHz	same values as with preselector on
	8 GHz ≤ f < 22 GHz	< 2 dB (σ = 0.6 dB)
	22 GHz ≤ f ≤ 26.5 GHz	< 2.5 dB (σ = 0.75 dB)
	26.5 GHz < f ≤ 50 GHz, span < 1 GHz	< 3 dB (σ = 1.0 dB)
	RF attenuation ≤ 20 dB, RF preamplifier on, +20 °C to +30 °C	
	f < 8 GHz	same values as with preselector on
	8 GHz ≤ f < 22 GHz	< 2 dB (σ = 0.6 dB)
	22 GHz ≤ f ≤ 26.5 GHz	< 2.5 dB (σ = 0.75 dB)
	26.5 GHz < f ≤ 50 GHz, span < 1 GHz	< 3 dB (σ = 1.0 dB)
Attenuator switching uncertainty	f = 64 MHz, 0 dB to 70 dB, referenced to 10 dB attenuation	< 0.2 dB (σ = 0.07 dB)
Uncertainty of reference level setting	input mixer level ≤ –15 dBm	0 dB [19]
	input mixer level > –15 dBm	< 0.1 dB (nom.)
Bandwidth switching uncertainty	referenced to RBW = 10 kHz, f = 64 MHz	< 0.2 dB (σ = 0.08 dB)

[19] The reference level setting affects only the graphical representation of the measurement result on the display, not the measurement itself. The reference level setting causes no additional uncertainty in measurement results.

Nonlinearity of displayed level		
Logarithmic level display	S/N > 16 dB, 0 dB ≤ level ≤ –70 dB	< 0.1 dB (σ = 0.04 dB)
	S/N > 16 dB, –70 dB < level ≤ –90 dB	< 0.2 dB (σ = 0.08 dB)
Linear level display	S/N > 16 dB, 0 dB to –70 dB	< 5 % of reference level (nom.)

Total measurement uncertainty		
YIG preselector on	signal level = 0 dB to –70 dB below reference level, S/N > 20 dB, sweep time = auto, RF attenuation = 10/20/30/40 dB, RF preamplifier off, electronic attenuator off, span/RBW < 100, 95 % confidence level, +20 °C to +30 °C	
	9 kHz ≤ f ≤ 10 MHz	±0.37 dB
	10 MHz < f ≤ 3.6 GHz	±0.27 dB
	3.6 GHz < f ≤ 8 GHz	±0.37 dB
	8 GHz < f ≤ 22 GHz	±1.4 dB
	22 GHz < f ≤ 26.5 GHz	±1.7 dB
	26.5 GHz < f ≤ 50 GHz	±2.5 dB
YIG preselector off	signal level = 0 dB to –70 dB below reference level, S/N > 20 dB, sweep time = auto, RF attenuation = 10/20/30/40 dB, RF preamplifier off, electronic attenuator off, span/RBW < 100, 95 % confidence level, +20 °C to +30 °C	
	8 GHz ≤ f ≤ 22 GHz	±1.0 dB
	22 GHz < f ≤ 26.5 GHz	±1.2 dB
	26.5 GHz < f ≤ 50 GHz	±1.7 dB

Trigger functions

Trigger		
Trigger source	spectrum analysis	free run, video, external, IF power, RF power
Trigger offset	span ≥ 10 Hz	5 ns to 20 s
	span = 0 Hz	(–sweep time) to 20 s
Minimum trigger offset resolution	span > 0 Hz	5 ns
	span = 0 Hz, trigger offset > 0	5 ns
	span = 0 Hz, trigger offset < 0	sweep time/number of sweep points
Maximum deviation of trigger offset		5 ns
IF power trigger		
Sensitivity	min. signal power	–60 dBm + RF attenuation – RF preamplifier gain (nom.)
	max. signal power	–10 dBm + RF attenuation – RF preamplifier gain (nom.)
IF power trigger bandwidth	RBW > 500 kHz	20 MHz (nom.) [20]
	RBW ≤ 500 kHz, FFT	20 MHz (nom.)
	RBW ≤ 500 kHz, swept	6 MHz (nom.)
RF power trigger		
Sensitivity	min. signal power	–30 dBm + RF attenuation – RF preamplifier gain (nom.)
	max. signal power	+10 dBm + RF attenuation – RF preamplifier gain (nom.)
RF power trigger frequency range	f ≤ 8 GHz	8 GHz (nom.)
	f > 8 GHz	center frequency ± 250 MHz (nom.) [21]
Gated sweep		
Gate source		video, external, IF power, RF power
Gate delay		5 ns to 20 s, min. resolution 5 ns
Gate length		5 ns to 20 s, min. resolution 5 ns
Maximum deviation of gate length		±5 ns

[20] Sweep optimization = auto.

[21] YIG preselector off for f ≥ 8 GHz.

I/Q data (R&S®FSWP-B1 option required)

Memory length		max. 440 Msample I and Q
Word length of I/Q samples	sampling rate > 100 MHz or number of samples > 300 Msample	18 bit
	otherwise	24 bit
Sampling rate	standard	100 Hz to 200 MHz
	with R&S®FSWP-B80 option	100 Hz to 200 MHz
	with R&S®FSWP-B320 option	100 Hz to 1 GHz
Maximum signal analysis bandwidth (equalized)	standard	10 MHz
	with R&S®FSWP-B80 option	80 MHz (nom.) [22]
	with R&S®FSWP-B320 option	320 MHz (nom.) [22]

Signal analysis bandwidth ≤ 80 MHz		
Amplitude flatness	(1.25 × signal analysis bandwidth) ≤ f_{center} < 8 GHz	±0.3 dB (nom.)
	f_{center} ≥ 8 GHz, YIG preselector off	±0.5 dB (nom.)
Deviation from linear phase	(1.25 × signal analysis bandwidth) ≤ f_{center} < 8 GHz	±1° (nom.)
	f_{center} ≥ 8 GHz, YIG preselector off	±2° (nom.)
Level display nonlinearity		see section Nonlinearity of displayed level
Level measurement uncertainty		see section Total measurement uncertainty, YIG preselector off
Third order intermodulation distortion		see section Third order intercept point (TOI)
ADC related spurious response	mixer level = –30 dBm [23]	
	analysis bandwidth < 17 MHz	–100 dBc (nom.)
	17 MHz ≤ analysis bandwidth < 80 MHz	–80 dBc (nom.)
Other spurious responses		see section Spurious responses

Signal analysis bandwidth 80 MHz to 160 MHz		
Amplitude flatness	RF attenuation = 10/20/30/40 dB, RF preamplifier off, electronic attenuator off, YIG preselector off for f ≥ 8 GHz	
	150 MHz ≤ f_{center} < 4 GHz	±0.5 dB (nom.)
	4 GHz ≤ f_{center} < 8 GHz	±0.7 dB (nom.)
	8 GHz ≤ f_{center} < 26.5 GHz	±1 dB (nom.)
	26.5 GHz ≤ f_{center} ≤ 50 GHz	±2 dB (nom.)
Deviation from linear phase	RF attenuation = 10/20/30/40 dB, RF preamplifier off, electronic attenuator off, YIG preselector off for f ≥ 8 GHz	
	150 MHz ≤ f_{center} < 4 GHz	±1° (nom.)
	4 GHz ≤ f_{center} < 8 GHz	±2° (nom.)
	8 GHz ≤ f_{center} < 26.5 GHz	±2.5° (nom.)
	26.5 GHz ≤ f_{center} < 43.5 GHz	±4° (nom.)
	43.5 GHz ≤ f_{center} ≤ 50 GHz	±8° (nom.)
Nonlinearity of displayed level	0 dB to –70 dB	< 0.15 dB (nom.)
Level measurement uncertainty at center frequency		add 0.2 dB (nom.) to the values in section Total measurement uncertainty, YIG preselector off
Third order intermodulation distortion	reference level = signal level + 6 dB	
	150 MHz ≤ f_{center} < 8 GHz: two –20 dBm tones at input mixer within analysis bandwidth [23], f_{center} ≥ 8 GHz: two –30 dBm tones at input mixer within analysis bandwidth [23]	–75 dBc (nom.)
Residual spurious response	RF attenuation 0 dB, f_{center} ≥ 150 MHz	–90 dBm (nom.)
ADC related spurious response	single tone within analysis bandwidth, mixer level = –10 dBm [23], reference level = signal level, f_{center} ≥ 150 MHz	–78 dBc (nom.)
Other spurious responses		see section Spurious responses

[22] YIG preselector off for f ≥ 8 GHz.

[23] Level of a tone at the input mixer (also abbreviated as mixer level) = signal level – RF attenuation + preamplifier gain.

Signal analysis bandwidth 160 MHz to 320 MHz		
Amplitude flatness	RF attenuation = 10/20/30/40 dB, RF preamplifier off, electronic attenuator off, YIG preselector off for f ≥ 8 GHz	
	200 MHz ≤ f_{center} < 4 GHz	±0.7 dB (nom.)
	4 GHz ≤ f_{center} < 7 GHz	±1.2 dB (nom.)
	7 GHz ≤ f_{center} < 8 GHz [24]	±1.4 dB (nom.)
	8 GHz ≤ f_{center} < 22 GHz	±1.6 dB (nom.)
	22 GHz ≤ f_{center} ≤ 43.5 GHz	±2 dB (nom.)
	43.5 GHz < f_{center} ≤ 50 GHz	±2.5 dB (nom.)
Deviation from linear phase	RF attenuation = 10/20/30/40 dB, RF preamplifier off, electronic attenuator off, YIG preselector off for f ≥ 8 GHz	
	200 MHz ≤ f_{center} < 4 GHz	±2.5° (nom.)
	4 GHz ≤ f_{center} < 8 GHz [24]	±4° (nom.)
	8 GHz ≤ f_{center} < 43.5 GHz	±5° (nom.)
	43.5 GHz ≤ f_{center} ≤ 50 GHz	±8° (nom.)
Nonlinearity of displayed level	0 dB to –70 dB	< 0.15 dB (nom.)
Level measurement uncertainty at center frequency		add 0.2 dB (nom.) to the values in section Total measurement uncertainty, YIG preselector off
Third order intermodulation distortion	reference level = signal level + 6 dB	
	200 MHz ≤ f_{center} < 8 GHz: two –20 dBm tones at input mixer within analysis bandwidth [23], f_{center} ≥ 8 GHz: two –30 dBm tones at input mixer within analysis bandwidth [23]	–75 dBc (nom.)
Residual spurious response	RF attenuation 0 dB, f_{center} ≥ 200 MHz	–90 dBm (nom.)
ADC related spurious response	single tone within analysis bandwidth, mixer level = –10 dBm [23], reference level = signal level	
	200 MHz ≤ f_{center} ≤ 460 MHz	–70 dBc (nom.)
	f_{center} > 460 MHz	–72 dBc (nom.)
Other spurious responses		see section Spurious responses

R&S®FSWP-B13 highpass filters (R&S®FSWP-B1 option required)

Frequency		
Frequency range	filter 1	1 GHz to 1.75 GHz
	filter 2	1.75 GHz to 3 GHz

Stopband attenuation		
500 MHz to 875 MHz	filter 1	> 20 dB (nom.)
875 MHz to 1.5 GHz	filter 2	> 20 dB (nom.)

Other specifications		
Level measurement uncertainty		see specifications in section R&S®FSWP-B1 spectrum analyzer
Displayed average noise level		
Intermodulation		
Measurement uncertainty		

[24] To obtain the set analysis bandwidth, (f_{center} + ½ analysis bandwidth) ≤ 8 GHz must be met.

R&S®FSWP-B21 LO/IF connections for external mixers (for R&S®FSWP26/R&S®FSWP50)

LO signal		
Frequency range		7.65 GHz to 16 GHz
Level	+20 °C to +30 °C	+15.5 dBm ± 1.5 dB
	+5 °C to +40 °C	+15.5 dBm ± 3 dB

IF input		
IF frequency	set signal analysis bandwidth	
	≤ 80 MHz, bandwidth-dependent	1310 MHz to 1330 MHz
Full-scale level	compression < 1 dB	
	2-port mixer (LO output/IF input, front panel)	–20 dBm (nom.)
	3-port mixer (IF input, front panel)	–20 dBm (nom.)
Level uncertainty at IF frequency	IF input level = reference level = –25 dBm, RBW = 30 kHz, mixer conversion loss set to 0 dB, 2-port mixer, LO output/IF input connector (front panel)	
	+20 °C to +30 °C	< 1 dB
	+5 °C to +40 °C	< 3 dB
	IF input level = reference level = –25 dBm, RBW = 30 kHz, mixer conversion loss set to 0 dB, 3-port mixer, IF input connector (front panel)	
	+20 °C to +30 °C	< 1 dB
	+5 °C to +40 °C	< 3 dB

Inputs and outputs		
LO output/IF input		SMA female, 50 Ω
IF input		SMA female, 50 Ω

Phase noise sensitivity with two external mixers in cross-correlation mode (R&S®FSWP-B60/R&S®FSWP-B61 and R&S®FSWP-B64 options required)

With R&S®FSWP-B61 and R&S®FSWP-B64 option:
Start offset 1 Hz, correlation factor = 1, frequency reference internal, internal reference loop bandwidth 30 Hz, signal level = 0 dBm, specified values in dBc (1 Hz), for typical values subtract 6 dB

RF input frequency	Supported mixer	Offset frequency from the carrier								
		1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz	≥ 30 MHz
50 GHz to 75 GHz	R&S®FS-Z75	–34	–53	–82	–115	–134	–135	–139	–145	–145
60 GHz to 90 GHz	R&S®FS-Z90	–33	–52	–81	–114	–133	–134	–138	–144	–144
75 GHz to 110 GHz	R&S®FS-Z110	–31	–50	–79	–112	–131	–132	–136	–142	–142

With R&S®FSWP-B60 and R&S®FSWP-B64 option:
Start offset 1 Hz, correlation factor = 1, frequency reference internal, internal reference loop bandwidth 30 Hz, signal level = 0 dBm, specified values in dBc (1 Hz), for typical values subtract 6 dB

RF input frequency	Supported mixer	Offset frequency from the carrier								
		1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz	≥ 30 MHz
50 GHz to 75 GHz	R&S®FS-Z75	–18	–46	–78	–110	–129	–132	–137	–145	–144
60 GHz to 90 GHz	R&S®FS-Z90	–17	–45	–77	–109	–128	–131	–136	–144	–143
75 GHz to 110 GHz	R&S®FS-Z110	–15	–43	–75	–107	–126	–129	–134	–142	–141

R&S®FSWP-B4 option improves the phase noise sensitivity at 1 Hz offset by 5 dB (nom.).
At other offsets the above specification applies.

Improvement of phase noise sensitivity by number of correlations				
Correlations	10	100	1000	10 000
Improvement	5 dB	10 dB	15 dB	20 dB

Phase noise sensitivity with one external mixer, with R&S®FSWP-B4 or R&S®FSWP-B61 option

Start offset 1 Hz, frequency reference internal, signal level > –10 dBm, nominal values in dBc (1 Hz)										
RF input frequency	**Supported mixer**	**Offset frequency from the carrier**								
		1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz	≥ 30 MHz
50 GHz to 75 GHz	R&S®FS-Z75	–32	–50	–75	–97	–114	–116	–124	–135	–137
60 GHz to 90 GHz	R&S®FS-Z90	–31	–49	–74	–96	–113	–115	–123	–133	–135
75 GHz to 110 GHz	R&S®FS-Z110	–29	–47	–72	–94	–111	–113	–121	–131	–133

Phase noise sensitivity with one external mixer, without R&S®FSWP-B4 or R&S®FSWP-B61 option

Start offset 1 Hz, frequency reference internal, signal level > –10 dBm, nominal values in dBc (1 Hz)										
RF input frequency	**Supported mixer**	**Offset frequency from the carrier**								
		1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz	≥ 30 MHz
50 GHz to 75 GHz	R&S®FS-Z75	–23	–45	–75	–97	–114	–116	–124	–135	–137
60 GHz to 90 GHz	R&S®FS-Z90	–22	–44	–74	–96	–113	–115	–123	–133	–135
75 GHz to 110 GHz	R&S®FS-Z110	–20	–42	–72	–94	–111	–113	–121	–131	–133

R&S®FSWP-B24 RF preamplifier (R&S®FSWP-B1 option required)

Frequency		
Frequency range	R&S®FSWP8	100 kHz to 8 GHz
	R&S®FSWP26	100 kHz to 26.5 GHz
	R&S®FSWP50	100 kHz to 50 GHz

Setting range		
RF preamplifier gain	R&S®FSWP8	15 dB/30 dB (nom.) (selectable)
	R&S®FSWP26, R&S®FSWP50	30 dB (nom.)

Other specifications		
Level measurement uncertainty		See spcifications in section R&S®FSWP-B1 spectrum analyzer; The RF preamplifier has no effect on phase noise analyzer specifications.
Displayed average noise level		
Intermodulation		
Measurement uncertainty		

R&S®FSWP-B64 additive phase noise measurements

Additive phase noise measurements

Frequency range	R&S®FSWP8	9.95 MHz to 8 GHz
	R&S®FSWP26	9.95 MHz to 18 GHz
	R&S®FSWP50	9.95 MHz to 18 GHz
Offset frequency range		10 mHz to 30 MHz
Measurement uncertainty		< 2 dB (nom.)
Input level measurement uncertainty	–20 dBm ≤ signal level ≤ +15 dBm, +20 °C to +30 °C	
	1 MHz ≤ signal frequency < 8 GHz	< 1.5 dB
	8 GHz ≤ signal frequency ≤ 18 GHz	< 2 dB

Additive phase noise sensitivity

Start offset 1 Hz, correlation factor = 10, signal level ≥ 10 dBm, specified values in dBc (1 Hz), for typical values subtract 6 dB								
RF input frequency	**Offset frequency from the carrier**							
	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	3 MHz
10 MHz	–106	–115	–128	–140	–148	–148	–148	–148
100 MHz	–118	–132	–143	–152	–155	–155	–155	–153
1 GHz	–115	–123	–137	–147	–160	–165	–165	–161
3 GHz	–115	–128	–143	–147	–165	–165	–160	–156
10 GHz	–85	–104	–120	–138	–148	–154	–164	–160
16 GHz	–82	–98	–120	–138	–148	–154	–164	–160

Additive AM noise sensitivity

Start offset 1 Hz, correlation factor = 10, signal level ≥ 10 dBm, nominal values in dBc (1 Hz)								
RF input frequency	**Offset frequency from the carrier**							
	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	3 MHz
10 MHz	–90	–105	–118	–134	–144	–148	–154	
100 MHz	–103	–115	–124	–137	–148	–155	–160	–160
1 GHz	–110	–115	–128	–140	–148	–155	–160	–160
3 GHz	–110	–115	–128	–140	–148	–155	–160	–160
10 GHz	–90	–104	–112	–120	–130	–138	–146	–150
16 GHz	–85	–99	–107	–117	–125	–133	–142	–147

Additive phase noise measurements with external signal source [25]

With R&S®FSWP-B64 option, the R&S®FSWP provides two auxiliary LO inputs to support the use of external signal sources. [26]
This allows additive phase noise measurements with two or three DUTs frequency translating or non-frequency translating.

Frequency range	R&S®FSWP8	100 MHz to 8 GHz
	R&S®FSWP26, R&S®FSWP50	100 MHz to 18 GHz
Offset frequency range		10 mHz to 30 MHz
Measurement uncertainty		< 2 dB (nom.)
Required LO drive level per input	level setting = low	
	100 MHz ≤ signal frequency < 12 GHz	–5 dBm
	12 GHz ≤ signal frequency < 16 GHz	0 dBm
	16 GHz ≤ signal frequency ≤ 18 GHz	+5 dBm
	level setting = high	
	100 MHz ≤ signal frequency < 12 GHz	+5 dBm
	12 GHz ≤ signal frequency < 16 GHz	+7 dBm
	16 GHz ≤ signal frequency ≤ 18 GHz	+10 dBm

Additive phase noise sensitivity with external signal source [25]

Start offset 1 Hz, correlation factor = 10, signal level ≥ 10 dBm, values in dBc (1 Hz) measured with a low phase noise reference [27]								
RF input frequency	**Offset frequency from the carrier**							
	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz
100 MHz	–125	–136	–150	–160	–170	–173	–175	–177
500 MHz	–118	–135	–148	–160	–175	–175	–175	–175
10 GHz	–100	–112	–124	–140	–150	–160	–160	–160

Additive AM noise sensitivity with external signal source [25]

Start offset 1 Hz, correlation factor = 10, signal level ≥ 10 dBm, values in dBc (1 Hz) measured with a low phase noise reference [27]								
RF input frequency	**Offset frequency from the carrier**							
	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz
100 MHz	–114	–125	–140	–155	–168	–175	–175	–175
10 GHz	–106	–115	–130	–140	–150	–160	–165	–165

Auxiliary LO inputs [26]

Inputs		
LO auxiliary input, channel 1	SMA (f), 50 Ω	max. input level +20 dBm
LO auxiliary input, channel 2	SMA (f), 50 Ω	max. input level +20 dBm

Additive phase noise measurements with external I/Q mixers

To extend the frequency range of the additive phase noise measurement, external I/Q mixers are supported.

Frequency range	dependent on used mixer	
	e.g. Marki Microwave MLIQ1845L	18 GHz to 45 GHz
Offset frequency range		10 mHz to 30 MHz
Required LO drive level	dependent on used mixer	
	e.g. Marki Microwave MLIQ1845L	11 dBm to 18 dBm

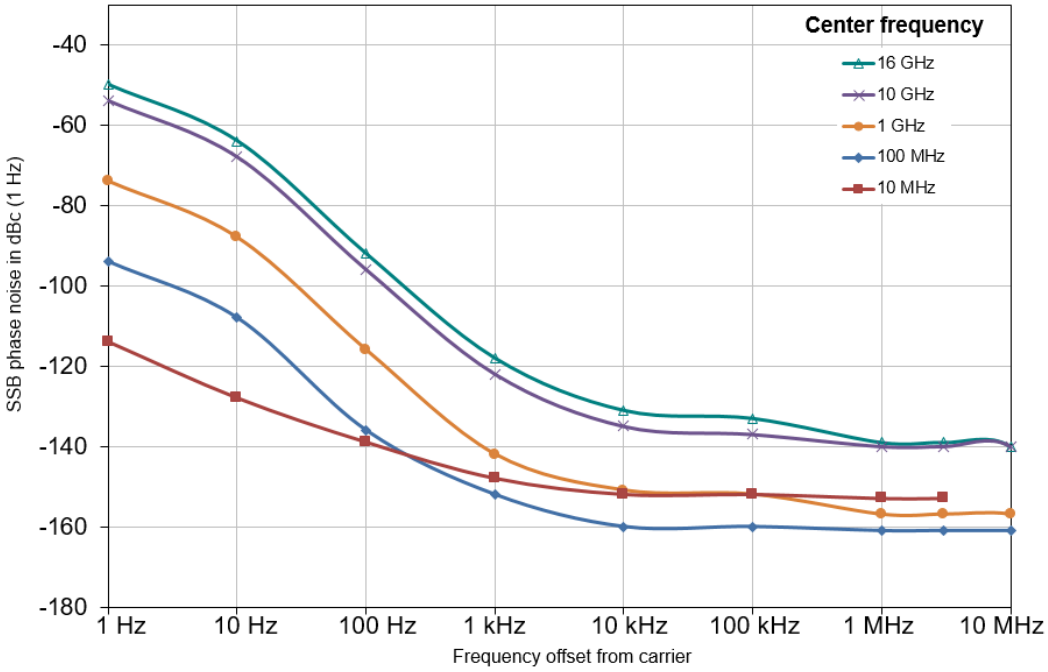
[25] Auxiliary LO inputs required.

[26] The auxiliary LO inputs are standard for instruments with R&S®FSWP-B64 option, starting from the following serial numbers: R&S®FSWP8: 101236, R&S®FSWP26: 101222, R&S®FSWP50: 101167.

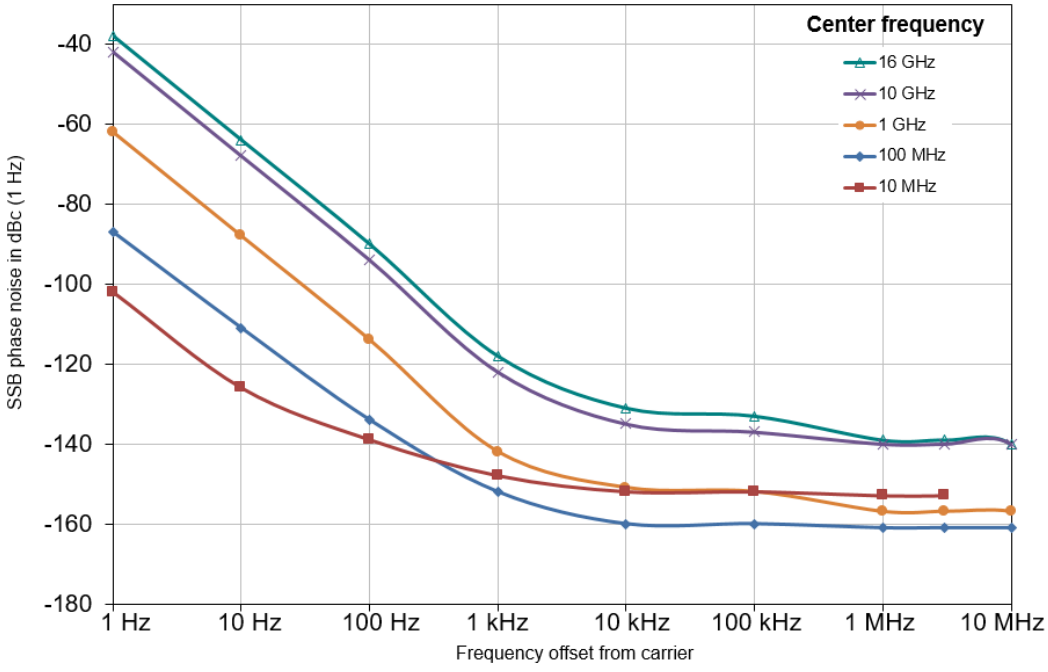
[27] Explanation of measured values: see section Definitions.

Signal source

Output level range		–60 dBm to +13 dBm, 0.1 dB steps [28]
Output level accuracy (+20 °C to +30 °C)	frequency 10 MHz to 16 GHz	± 2 dB
	frequency 16 GHz to 18 GHz	+2 dB to –5 dB



Typical phase noise of signal source output with R&S®FSWP-B61 option



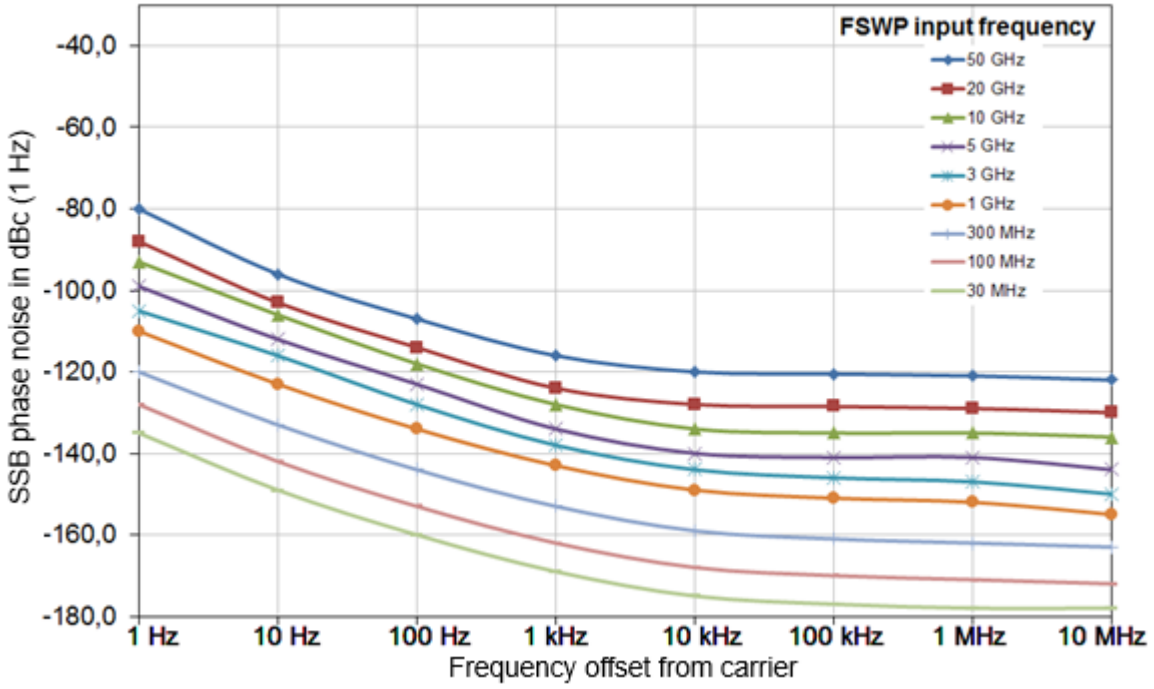
Typical phase noise of signal source output with R&S®FSWP-B60 option

[28] For instruments with R&S®FSWP-B64 option with the part number 1322.9900.26, the output level range is –50 dBm to +10 dBm, 10 dB steps.

Frequency translating additive phase noise measurements

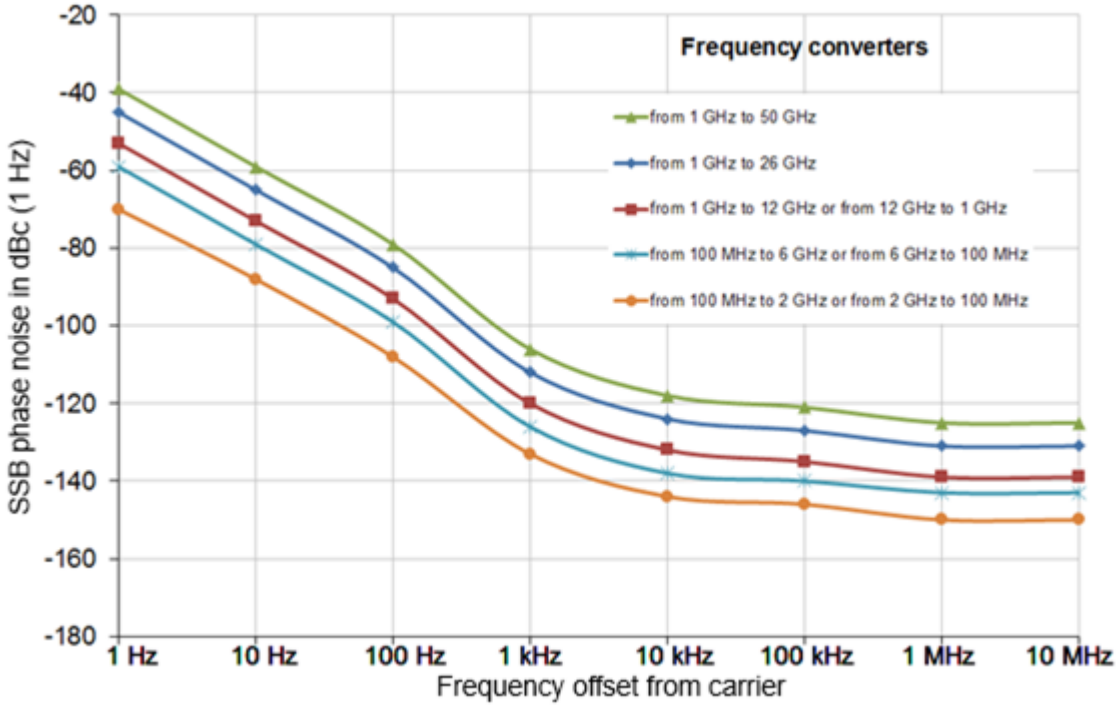
This measurement is performed in phase noise mode with the signal source used as input signal for the frequency translating device. In this test setup, the signal source and the receiving signal path use the same internal reference frequency for the synthesizers. Therefore the close in phase noise cancels if the DUT is a frequency divider, a frequency multiplier or a DDS chip (which uses the signal source output as clock signal). For this measurement the phase noise sensitivity depends mainly on the input frequency of the R&S®FSWP. Using the R&S®FSWP it is also possible to measure frequency converters with internal local oscillator. In this case the sensitivity is dependent on the frequency difference between RF input and signal source output. For typical phase noise sensitivity see the diagrams below.		
Frequency range of signal source output	R&S®FSWP8	9.95 MHz to 8 GHz
	R&S®FSWP26	9.95 MHz to 18 GHz
	R&S®FSWP50	9.95 MHz to 18 GHz
Frequency range of input signal		see Additive phase noise measurements
Offset frequency range		see Additive phase noise measurements
Measurement uncertainty		see Additive phase noise measurements

Frequency translating additive phase noise sensitivity [29]



Typical phase noise sensitivity of frequency divider or frequency multiplier measurements (start offset = 1 Hz, correlation factor = 10)

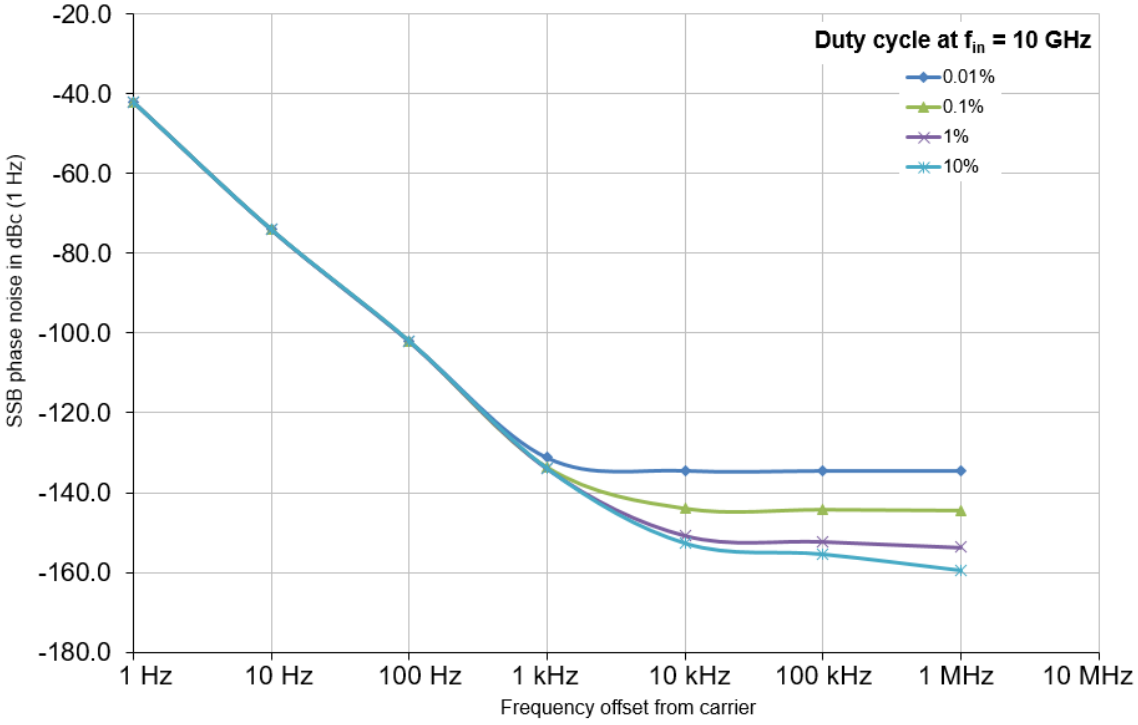
[29] The typical data shown in the diagrams apply to instruments starting from the following serial numbers: R&S®FSWP8: 101233, R&S®FSWP26: 101221, R&S®FSWP50: 101165.



Typical phase noise sensitivity of frequency converter measurements with R&S®FSWP-B61 option (start offset = 1 Hz, correlation factor = 10)

R&S®FSWP-K4 pulsed phase noise measurements

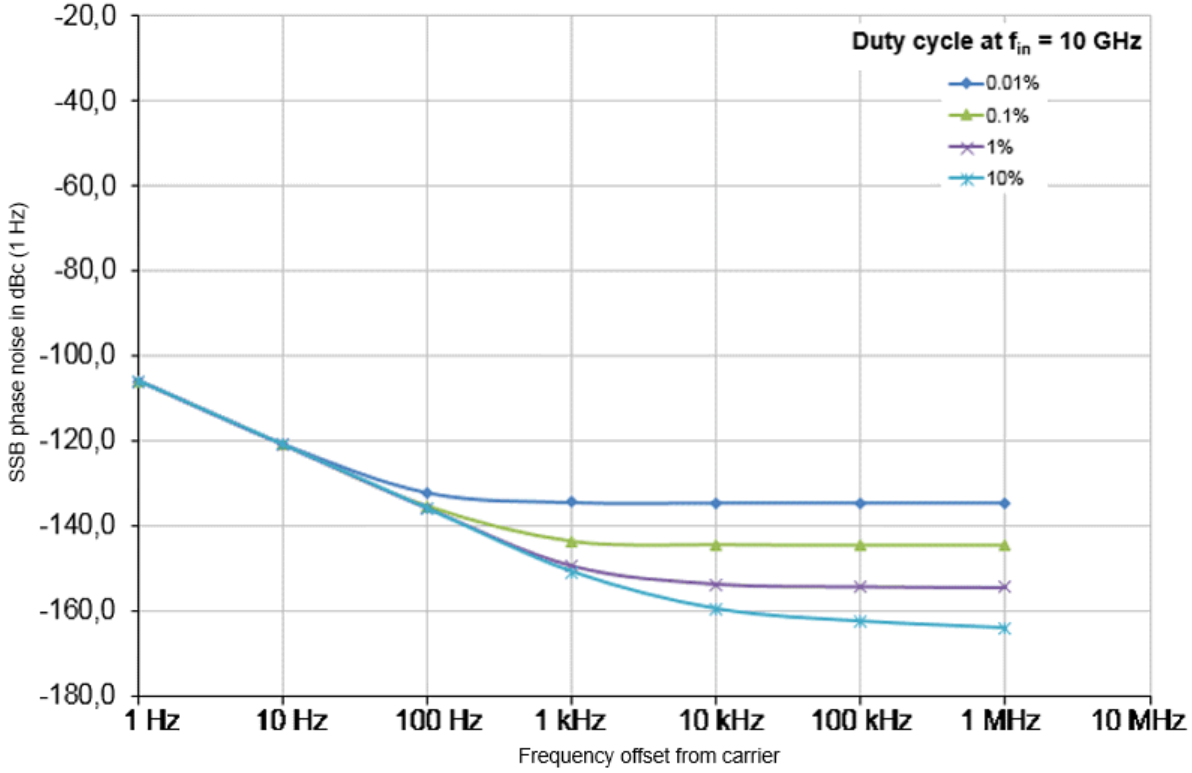
Signal level ≥ 0 dBm		
Offset frequency range		10 mHz to 50 % of the pulse repetition rate
Pulse repetition rate		0.5 µs to 5 ms
Duty cycle	manual setting, auto search off	0.01 % to 50 %, pulse width > 100 ns
	auto search on	1 % to 50 %, pulse width > 250 ns
Phase noise measurement uncertainty	10 mHz < offset < 1 Hz	< 3 dB
	1 Hz ≤ offset ≤ 1 MHz	< 2.5 dB
Phase noise sensitivity	The phase noise sensitivity is limited by additional broadband noise dependent on the duty cycle of the input signal. As long as this broadband noise is more than 10 dB below the specified phase noise sensitivity for continuous wave signals, the phase noise sensitivity specification for CW signals applies.	
Noise floor of phase noise sensitivity	start offset = 1 Hz, correlation factor = 1, signal level ≥ 10 dBm	
	gating = on	
	frequency < 18 GHz	–175 dBc (1 Hz) – 10 log(duty cycle) (nom.)
	18 GHz ≤ frequency < 30 GHz	–165 dBc (1 Hz) – 10 log(duty cycle) (nom.)
	30 GHz ≤ frequency ≤ 50 GHz	–155 dBc (1 Hz) – 10 log(duty cycle) (nom.)
	gating = off	
	frequency < 18 GHz	–175 dBc (1 Hz) – 20 log(duty cycle) (nom.)
	18 GHz ≤ frequency < 30 GHz	–165 dBc (1 Hz) – 20 log(duty cycle) (nom.)
	30 GHz ≤ frequency ≤ 50 GHz	–155 dBc (1 Hz) – 20 log(duty cycle) (nom.)



Typical phase noise sensitivity with R&S®FSWP-B60 or R&S®FSWP-B61 option at f_{in} = 10 GHz (start offset = 1 Hz, correlation factor = 1, signal level = 10 dBm, gating = on)

R&S®FSWP-K4 pulsed AM noise measurements

Signal level ≥ 0 dBm		
Offset frequency range		10 mHz to 50 % of the pulse repetition rate
Pulse repetition rate		0.5 µs to 5 ms
Duty cycle	manual setting, auto search off	0.01 % to 50 %, pulse width > 100 ns
	auto search on	1 % to 50 %, pulse width > 250 ns
AM noise measurement uncertainty	10 mHz < offset < 1 Hz	< 3 dB
	1 Hz ≤ offset ≤ 1 MHz	< 2.5 dB
AM noise sensitivity	The AM noise sensitivity is limited by additional broadband noise dependent on the duty cycle of the input signal. As long as this broadband noise is more than 10 dB below the specified AM noise sensitivity for continuous wave signals, the phase noise sensitivity specification for CW signals applies.	
Noise floor of phase noise sensitivity	start offset = 1 Hz, correlation factor = 1, signal level ≥ 10 dBm	
	gating = on	
	frequency < 18 GHz	–175 dBc (1 Hz) – 10 log(duty cycle) (nom.)
	18 GHz ≤ frequency < 30 GHz	–165 dBc (1 Hz) – 10 log(duty cycle) (nom.)
	30 GHz ≤ frequency ≤ 50 GHz	–155 dBc (1 Hz) – 10 log(duty cycle) (nom.)
	gating = off	
	frequency < 18 GHz	–175 dBc (1 Hz) – 20 log(duty cycle) (nom.)
	18 GHz ≤ frequency < 30 GHz	–165 dBc (1 Hz) – 20 log(duty cycle) (nom.)
	30 GHz ≤ frequency ≤ 50 GHz	–155 dBc (1 Hz) – 20 log(duty cycle) (nom.)



Typical AM noise sensitivity at f_{in} = 10 GHz
(start offset = 1 Hz, correlation factor = 1, signal level = 10 dBm, gating = on)

R&S®FSWP-K980 health and utilization monitoring service (HUMS)

Health and utilization monitoring service (HUMS) [30, 31]		
Interfaces	protocols and interfaces supported for data readout and display	• SNMP (v1, v2c, v3) • REST (JSON) • SCPI • device web
Services	information provided	• device information (model, serial number, BIOS, date, time, system, HUMS and software information) • user-defined information tags (e.g. for asset management) • equipment information (hardware, options, software, licenses) • system operating status • instrument security information • service related information (due dates etc.) • mass storage related information • instrument utilization data • device history (event log)

[30] For details see application note under: www.rohde-schwarz.com/appnote/GFM336.

[31] For use with common available asset management tools.

Ordering information

Designation	Type	Order No.
Phase noise analyzer and VCO tester, 1 MHz to 8 GHz	R&S®FSWP8	1322.8003.08
Phase noise analyzer and VCO tester, 1 MHz to 26.5 GHz	R&S®FSWP26	1322.8003.26
Phase noise analyzer and VCO tester, 1 MHz to 50 GHz	R&S®FSWP50	1322.8003.50
Accessories supplied		
Power cable, quick start guide, R&S®FSWP26: adapter, 3.5 mm (APC3.5-compatible), female/female, R&S®FSWP50: adapter, 1.85 mm, female/female		

Options

Designation	Type	Order No.	Retrofittable	Remarks
Cross-correlation, 8 GHz	R&S®FSWP-B60	1322.9800.08	yes	for R&S®FSWP8, contact service center
Cross-correlation, 26 GHz	R&S®FSWP-B60	1322.9800.26	yes	for R&S®FSWP26, retrofittable in factory
Cross-correlation, 50 GHz	R&S®FSWP-B60	1322.9800.50	yes	for R&S®FSWP50, retrofittable in factory
Cross-correlation (low phase noise), 8 GHz	R&S®FSWP-B61	1325.3719.08	yes	for R&S®FSWP8, contact service center, includes R&S®FSWP-B4
Cross-correlation (low phase noise), 26 GHz	R&S®FSWP-B61	1325.3719.26	yes	for R&S®FSWP26, retrofittable in factory, includes R&S®FSWP-B4
Cross-correlation (low phase noise), 50 GHz	R&S®FSWP-B61	1325.3719.50	yes	for R&S®FSWP50, retrofittable in factory, includes R&S®FSWP-B4
Additive phase noise measurements	R&S®FSWP-B64	1322.9900.27	yes	frequency range 10 MHz to 8 GHz for R&S®FSWP8, 10 MHz to 18 GHz for R&S®FSWP26 and R&S®FSWP50, R&S®FSWP-B60 or R&S®FSWP-B61 options required, contact service center
High stability OCXO	R&S®FSWP-B4	1325.3890.02	yes	user-retrofittable
Spectrum analyzer, 10 Hz to 8 GHz	R&S®FSWP-B1	1322.9997.08	yes	for R&S®FSWP8, retrofittable in factory
Spectrum analyzer, 10 Hz to 26 GHz	R&S®FSWP-B1	1322.9997.26	yes	for R&S®FSWP26, retrofittable in factory
Spectrum analyzer, 10 Hz to 50 GHz	R&S®FSWP-B1	1322.9997.50	yes	for R&S®FSWP50, retrofittable in factory
External generator control	R&S®FSWP-B10	1325.5463.02	yes	for R&S®FSWP8/26/50 with R&S®FSWP-B1 option, contact service center
Resolution bandwidth up to 80 MHz	R&S®FSWP-B8	1325.5028.26	no	for R&S®FSWP8/26 with R&S®FSWP-B1 option; The signal analysis bandwidth is defined by the R&S®FSWP-B80 option, not by the R&S®FSWP-B8 option.
Resolution bandwidth up to 80 MHz	R&S®FSWP-B8	1325.5028.02	no	for R&S®FSWP50 with R&S®FSWP-B1 option; The signal analysis bandwidth is defined by the R&S®FSWP-B80 option, not by the R&S®FSWP-B8 option. Export license required
Resolution bandwidth up to 40 MHz	R&S®FSWP-B8E	1338.7099.02	yes	for R&S®FSWP8/26/50 with R&S®FSWP-B1 option; The signal analysis bandwidth is defined by the R&S®FSWP-B80/320 option, not by the R&S®FSWP-B8E option.

Designation	Type	Order No.	Retrofittable	Remarks
				User-retrofittable
Highpass filter, for harmonic measurements	R&S®FSWP-B13	1325.4350.02	yes	for R&S®FSWP8/26/50 with R&S®FSWP-B1 option, user-retrofittable
LO/IF connections, for external mixers	R&S®FSWP-B21	1325.3848.02	yes	for R&S®FSWP26/50, contact service center
RF preamplifier, 100 kHz to 8 GHz	R&S®FSWP-B24	1325.3725.08	yes	for R&S®FSWP8 with R&S®FSWP-B1 option, contact service center
RF preamplifier, 100 kHz to 26.5 GHz	R&S®FSWP-B24	1325.3725.26	yes	for R&S®FSWP26 with R&S®FSWP-B1 option, contact service center
RF preamplifier, 100 kHz to 50 GHz	R&S®FSWP-B24	1325.3725.50	yes	for R&S®FSWP50 with R&S®FSWP-B1 option, contact service center
80 MHz analysis bandwidth	R&S®FSWP-B80	1325.4338.02	yes	for R&S®FSWP8/26/50 with R&S®FSWP-B1 option, user-retrofittable
320 MHz analysis bandwidth	R&S®FSWP-B320	1338.3235.04	yes	for R&S®FSWP8/26/50 with R&S®FSWP-B1 option, contact service center
Spare solid-state drive (removable hard drive)	R&S®FSWP-B18	1331.4313.02	yes	user-retrofittable

Firmware

Designation	Type	Order No.	Remarks
Pulsed phase noise measurements	R&S®FSWP-K4	1325.5043.02	
Pulse measurement application	R&S®FSWP-K6	1325.4221.02	R&S®FSWP-B1 option required
Pulse stability measurements	R&S®FSWP-K6P	1338.3106.02	R&S®FSWP-B1, R&S®FSWP-B64 and R&S®FSWP-K6 options required
Time sidelobe measurements	R&S®FSWP-K6S	1325.5363.02	R&S®FSWP-B1 and R&S®FSWP-K6 options required
AM/FM/PM modulation analysis	R&S®FSWP-K7	1325.4238.02	R&S®FSWP-B1 option required
Noise power ratio measurements	R&S®FSWP-K19	1350.5963.02	R&S®FSWP-B1 option required
Noise figure measurements	R&S®FSWP-K30	1325.4244.02	R&S®FSWP-B1 option required
Security write protection of solid state drive	R&S®FSWP-K33	1325.5040.02	
Spurious measurements	R&S®FSWP-K50	1338.3358.02	R&S®FSWP-B1 option required
Transient measurements	R&S®FSWP-K60	1338.4525.02	R&S®FSWP-B1 option required
Transient chirp measurements	R&S®FSWP-K60C	1338.4531.02	R&S®FSWP-B1 and R&S®FSWP-K60 options required
Transient hop measurements	R&S®FSWP-K60H	1338.4548.02	
Vector signal analysis	R&S®FSWP-K70	1325.4280.02	R&S®FSWP-B1 option required
Multi-modulation analysis	R&S®FSWP-K70M	1350.6860.02	R&S®FSWP-B1 and R&S®FSWP-K70 options required
BER PRBS measurements	R&S®FSWP-K70P	1350.6876.02	R&S®FSWP-B1 and R&S®FSWP-K70 options required
Health and utilization monitoring service (HUMS)	R&S®FSWP-K980	1350.6724.02	

Recommended extras

Designation	Type	Order No.
IEC/IEEE bus cable, length: 1 m	R&S®PCK	0292.2013.10
IEC/IEEE bus cable, length: 2 m	R&S®PCK	0292.2013.20
Front cover	R&S®ZZF-511	1174.8825.00
19" rack adapter	R&S®ZZA-KN5	1175.3040.00
Matching pads, 50/75 Ω		
L section, matching at both ends	R&S®RAM	0358.5414.02
Series resistor, 25 Ω, matching at one end (taken into account in instrument function RF INPUT 75 Ω)	R&S®RAZ	0358.5714.02
High-power attenuators		
100 W, 3 dB, 1 GHz	R&S®RBU100	1073.8495.03
100 W, 6 dB, 1 GHz	R&S®RBU100	1073.8495.06
100 W, 10 dB, 1 GHz	R&S®RBU100	1073.8495.10
100 W, 20 dB, 1 GHz	R&S®RBU100	1073.8495.20
100 W, 30 dB, 1 GHz	R&S®RBU100	1073.8495.30
50 W, 3 dB, 2 GHz	R&S®RBU50	1073.8695.03
50 W, 6 dB, 2 GHz	R&S®RBU50	1073.8695.06
50 W, 10 dB, 2 GHz	R&S®RBU50	1073.8695.10
50 W, 20 dB, 2 GHz	R&S®RBU50	1073.8695.20
50 W, 30 dB, 2 GHz	R&S®RBU50	1073.8695.30
50 W, 20 dB, 6 GHz	R&S®RDL50	1035.1700.52
Connectors and cables		
Coaxial adapter, N (f)/3.5 mm (f), APC3.5-compatible	(for R&S®FSWP8)	3587.7829.00
Coaxial adapter, 3.5 mm (f/f), APC3.5-compatible	(for R&S®FSWP26)	3587.7793.00
Coaxial adapter, 1.85 mm (f/f), APC2.4-compatible	(for R&S®FSWP50)	3588.9654.00
RF cable, length: 50 cm, SMA (f/f)	(for R&S®FSWP-B21)	3586.9970.00
Cable with ferrite bead, length: 1 m, BNC (m/m), for V tune port		1322.8861.00
Probe power connector, 3-pin		1065.9480.00
N-type adapter, for R&S®RT-Zxx oscilloscope probes	R&S®RT-ZA9	1417.0909.02
DC block		
DC block, 10 kHz to 18 GHz (N-type)	R&S®FSE-Z4	1084.7443.03
External harmonic mixers (for instruments with R&S®FSWP-B21 option)		
Harmonic mixer, 40 GHz to 60 GHz	R&S®RPG FS-Z60	1048.0171.02
Harmonic mixer, 50 GHz to 75 GHz	R&S®RPG FS-Z75	3638.2240.02
Harmonic mixer, 60 GHz to 90 GHz	R&S®RPG FS-Z90	3638.2270.02
Harmonic mixer, 75 GHz to 110 GHz	R&S®RPG FS-Z110	3638.2292.02
Harmonic mixer, 90 GHz to 140 GHz	R&S®RPG FS-Z140	3622.0708.02
Harmonic mixer, 110 GHz to 170 GHz	R&S®RPG FS-Z170	3622.0714.02
Harmonic mixer, 140 GHz to 220 GHz	R&S®RPG FS-Z220	3593.3250.02
Harmonic mixer, 220 GHz to 325 GHz	R&S®RPG FS-Z325	3593.3267.02
Harmonic mixer, 325 GHz to 500 GHz	R&S®RPG FS-Z500	3593.3273.02
External I/Q mixer (for instruments with R&S®FSWP-B64 option)		
I/Q mixer from Marki Microwave	MLIQ1845L	

Power sensors supported (R&S®FSWP-B1 option required) [32]

Designation	Type	Order No.
Universal power sensors		
10 MHz to 8 GHz, 100 mW, two-path	R&S®NRP-Z211	1417.0409.02
10 MHz to 8 GHz, 200 mW	R&S®NRP-Z11	1138.3004.02
10 MHz to 18 GHz, 100 mW, two-path	R&S®NRP-Z221	1417.0309.02
10 MHz to 18 GHz, 200 mW	R&S®NRP-Z21	1137.6000.02
10 MHz to 18 GHz, 2 W	R&S®NRP-Z22	1137.7506.02
10 MHz to 18 GHz, 15 W	R&S®NRP-Z23	1137.8002.02
10 MHz to 18 GHz, 30 W	R&S®NRP-Z24	1137.8502.02
Power sensor modules with power splitter		
DC to 18 GHz, 500 mW	R&S®NRP-Z27	1169.4102.02
DC to 26.5 GHz, 500 mW	R&S®NRP-Z37	1169.3206.02
Thermal power sensors		
0 Hz to 18 GHz, 100 mW	R&S®NRP18T	1424.6115.02
0 Hz to 18 GHz, 100 mW	R&S®NRP18TN	1424.6121.02
0 Hz to 33 GHz, 100 mW	R&S®NRP33T	1424.6138.02
0 Hz to 33 GHz, 100 mW	R&S®NRP33TN	1424.6144.02
0 Hz to 40 GHz, 100 mW	R&S®NRP40T	1424.6150.02
0 Hz to 40 GHz, 100 mW	R&S®NRP40TN	1424.6167.02
0 Hz to 50 GHz, 100 mW	R&S®NRP50T	1424.6173.02
0 Hz to 50 GHz, 100 mW	R&S®NRP50TN	1424.6180.02
0 Hz to 67 GHz, 100 mW	R&S®NRP67T	1424.6196.02
0 Hz to 67 GHz, 100 mW	R&S®NRP67TN	1424.6209.02
0 Hz to 110 GHz, 100 mW	R&S®NRP110T	1424.6215.02
Average power sensors		
8 kHz to 6 GHz, 200 mW	R&S®NRP6A	1424.6796.02
8 kHz to 6 GHz, 200 mW	R&S®NRP6AN	1424.6809.02
9 kHz to 6 GHz, 2 W	R&S®NRP-Z92	1171.7005.02
8 kHz to 18 GHz, 200 mW	R&S®NRP18A	1424.6815.02
8 kHz to 18 GHz, 200 mW	R&S®NRP18AN	1424.6821.02
Three path diode power sensors		
100 pW to 200 mW, 10 MHz to 8 GHz	R&S®NRP8S	1419.0006.02
100 pW to 200 mW, 10 MHz to 8 GHz, LAN version	R&S®NRP8SN	1419.0012.02
100 pW to 200 mW, 10 MHz to 18 GHz	R&S®NRP18S	1419.0029.02
100 pW to 200 mW, 10 MHz to 18 GHz, LAN version	R&S®NRP18SN	1419.0035.02
100 pW to 200 mW, 10 MHz to 33 GHz	R&S®NRP33S	1419.0064.02
100 pW to 200 mW, 10 MHz to 33 GHz, LAN version	R&S®NRP33SN	1419.0070.02
100 pW to 100 mW, 50 MHz to 40 GHz	R&S®NRP40S	1419.0041.02
100 pW to 100 mW, 50 MHz to 40 GHz, LAN version	R&S®NRP40SN	1419.0058.02
Wideband power sensor		
50 MHz to 18 GHz, 100 mW	R&S®NRP-Z81	1137.9009.02

[32] For average power measurement only.

Service options

Service options		
Extended warranty, one year	R&S®WE1	Please contact your local Rohde & Schwarz sales office.
Extended warranty, two years	R&S®WE2	
Extended warranty with calibration coverage, one year	R&S®CW1	
Extended warranty with calibration coverage, two years	R&S®CW2	
Extended warranty with accredited calibration coverage, one year	R&S®AW1	
Extended warranty with accredited calibration coverage, two years	R&S®AW2	

Extended warranty with a term of one to four years (WE1 to WE2)
Repairs carried out during the contract term are free of charge [33]. Necessary calibration and adjustments carried out during repairs are also covered. Simply contact the forwarding agent we name; your product will be picked up free of charge and returned to you in top condition a couple of days later.

Extended warranty with calibration (CW1 to CW2)
Enhance your extended warranty by adding calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated, inspected and maintained during the term of the contract. It includes all repairs [33] and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

Extended warranty with accredited calibration (AW1 and AW2)
Enhance your extended warranty by adding accredited calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated under accreditation, inspected and maintained during the term of the contract. It includes all repairs [33] and accredited calibration at the recommended intervals as well as any accredited calibration carried out during repairs or option upgrades.

[33] Excluding defects caused by incorrect operation or handling and force majeure. Wear-and-tear parts are not included.

Service that adds value

- ► Worldwide
- ► Local and personalized
- ► Customized and flexible
- ► Uncompromising quality
- ► Long-term dependability

Rohde&Schwarz

The Rohde&Schwarz technology group is among the trailblazers when it comes to paving the way for a safer and connected world with its leading solutions in test&measurement, technology systems, and networks&cybersecurity. Founded more than 85 years ago, the group is a reliable partner for industry and government customers around the globe. The independent company is headquartered in Munich, Germany and has an extensive sales and service network with locations in more than 70 countries.

www.rohde-schwarz.com

Sustainable product design

- ► Environmental compatibility and eco-footprint
- ► Energy efficiency and low emissions
- ► Longevity and optimized total cost of ownership

Certified Quality Management
ISO 9001

Certified Environmental Management
ISO 14001

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